

Birla Central Library

PILANI (Jaipur State)

Class No :- 582.16

Book No :- S18 F

Accession No :- 35553

FIELD MANUAL *of* TREES

Including Southern Canada and the
Northern United States to Approx-
imately the Southern Boundary of Vir-
ginia, Kentucky and Missouri, West-
ward to the Limits of the Prairie

FOURTH REVISED EDITION

By

JOHN H. SCHAFFNER

*Research Professor of Botany
and formerly Head of the Department of Botany,
Ohio State University*

R. G. ADAMS & COMPANY
Columbus, Ohio

1936

Copyright 1936
By
John H. Schaffner

PREFACE

This little manual represents a revision of the author's former "Trees of Ohio and Surrounding Territory," and attempts to carry out more definitely the idea of having a convenient guide by which it is possible to study our trees at any season of the year. The keys have been made very complete so that no difficulty should be encountered in identification except in the case of closely related species. No elaborate technical descriptions have been given but a few brief notes are added in connection with each species, calling attention to economic, ecological, or other data of general interest. Characters given in the keys are usually not repeated in the descriptions. A definite characterization is also given for each genus. This will be found to hold for all the species occurring in our region and in most cases for all the species of the genus.

The nomenclature is in agreement with the International Rules of Botanical Nomenclature and a few changes in names from those used in previous editions will be found. Only three generic names are involved but a considerable number of specific names, some through the application of the rules and some from our more advanced knowledge of the subject. A rather conservative position has been taken in the treatment of species since many of the forms recently described are regarded as merely elementary varieties either Mendelian or ecological. A single English name is given for each species, and this has been selected with great care. Synonyms will be found in the index.

Some of our common, cultivated, exotic trees have been included, since these form an integral part of the landscape, in many places more conspicuous than the native species.

The study of trees may be made a pleasant and profitable pastime at any season of the year for all who have an interest in nature. When the tree has once been identified its

as it frequently happens when some of the cross walls are broken down in a vertical series of cells. The large cells in the wood, however, are called wood vessels. Just how the water is able to pass up to the tops of high trees is not fully understood. In early spring, as in the sugar maple, the water accumulates in the sap wood, since there are no leaves from which it can be thrown off above.

The crown is a system of branches on which the leaves are developed and exposed to the light. In the leaves most of the food is manufactured which the tree uses for its growth and nourishment. This production of organic food is carried on through the agency of sunlight and chlorophyll, as the green coloring matter is called. Another important function of the leaves is the transpiration of the surplus water brought up from below. The water transpired by a large tree in a single day is often very great in amount. The leaves are also important breathing organs, although not exclusively so; for all the living cells in the entire plant carry on the process of respiration.

The system of branching in the crown may be of various types. If the main trunk of a tree extends upward through the crown to the tip it is said to be excurrent, as in the larch and white pine. When the terminal bud has no preeminence over others and the main trunk is soon lost, the tree is round-topped or spreading and is said to be deliquescent, as in the apple. Excurrent trees are often spire-shaped like the Norway spruce; while deliquescent stems commonly give rise to dome-shaped crowns, as in the white elm. If the terminal bud withers or is self-pruned, as in the linden or elm, the branching is sympodial. If the leaves are opposite and the two lateral end buds develop, the terminal bud being self-pruned, the result is a sympodial dichotomy, as in the bladder-nut. Trees in which the terminal buds are persistent and functional are said to have a monopodial system of branching.

The trunk or any branch of a coniferous or dicotylous tree consists of four main parts, the pith, the wood, the cambium or growing layer, and the bark. The wood consists of a series of annual rings, since if normal growth takes place only a single ring is produced each year. Each ring

usually consists of two layers called early wood and late wood. During special seasons or if growth is checked at times during the growing period more than one ring may be produced, although this is never perfect and can usually be detected by careful examination. In most trees the inner part of the wood and the pith are dead and this is called the heart wood or duramen, while the outer wood is lighter in color with living cells next the cambium layer, and is called the sap-wood or alburnum. Sometimes there is a striking difference in the color of the two parts. Strands of cells pass from the pith or annual rings through the wood to the bark. These are called medullary rays. The peculiar qualities of wood are due to the character of its cells which have their walls lignified or thickened by deposits of lignin and cellulose.

The bark usually consists of two main layers called inner bark and outer bark. The inner bark is often in very thin layers and is hence called liber. The outer bark is very diverse in character. Usually it consists mainly of layers of cork cells which are very impervious to water. Since the outer bark usually does not increase in diameter as rapidly as the wood it is finally torn into strips and peels off on the outside. Trees have many interesting ways of developing and getting rid of their outer bark.

More commonly the outer bark is developed as follows: In a young main stem or twig there is a tissue between the outer layer of cells or epidermis and the circle of vascular bundles which is called the cortex. While the stem is developing and hardening, the outermost layer of cortical cells just below the epidermis is modified and begins to grow. This layer is the cork cambium or phellogen. The layer of tissue thus formed by the repeated divisions of the cells of the phellogen is called the periderm or cork. On the inner side of the phellogen another layer of tissue is produced which is called the phelloderm or secondary cortex. The phellogen may continue to produce periderm until the outer bark becomes very thick; and finally new cork cambiums may develop farther in the cortex or even in the phloem of the inner bark. In some plants the cork cambium originates from the epidermis and in some from the deeper layers of the cortex.

Some trees have no special means of shedding their leaves while others shed them only after a year or more. Most of our indigenous species are "deciduous," that is they cast their leaves at the end of each growing season by the formation of a cleavage plane or separation layer through the base of the petiole. Some also prepare for winter by developing elaborate winter buds. The function of the winter buds is mainly advantageous in checking evaporation from the delicate stem tips during the periods of freezing and thawing. Some trees have so-called naked buds, that is buds without any special scale leaves.

Many of the smaller branches and twigs of a tree, especially when growing in a dense forest, are continually dying off. But the tree rids itself of these dead branches by forming a collar of tissue from the cambium layer around the base of the dead branch, which finally covers over the wound when the dead member falls off. This process is known as natural pruning. By the formation of a similar callus other wounds are covered up. There is still a more remarkable process present in many trees by which surplus living branches are cut off in one way or another. Terminal and lateral buds are also commonly cut off. This process of abscission is known as self-pruning. The most common method is by the formation of a cleavage plane in a basal joint or in the annual nodes of growth. In some genera brittle zones are produced. The self-pruning process is very highly developed in the cottonwood, white oak, white elm, and silver maple.

Trees grow in height only at the tips of the main stem or branches. Some trees are naturally shortlived; others attain an enormous size and age, but from the very nature of their upright development their life must sooner or later come to an end. In some cases the individual organism may continue by a new development from sprouts growing out of the stump or the roots.

All of our native trees bear flowers and seeds. After arriving at a certain age depending on the species, the tips of some twigs or the axillary buds will develop flowers. In the more highly developed and typical flowers, as in the Anthophyta, four sets of organs are present: the calyx composed of sepals, the corolla composed of petals, the andrecium com-

posed of stamens, and the gynecium composed of carpels. The two essential sets of organs in the flower are the stamens and the carpels. These are the sporophylls and may both be in the same flower, when the flower is said to be bisporangiate or in separate flowers, when the flower is monosporangiate. If the staminate and carpellate flowers are on one individual the plant is monocious, if on two distinct individuals the plant is diecious. In this case the plants are spoken of as staminate trees and carpellate trees. The stamens produce microsporangia and the carpels megasporangia or ovules. In the Anthophyta the carpel usually has three parts called stigma, style and ovulary, the ovules being completely inclosed in the ovulary. Commonly all the carpels of the gynecium are grown together and in such cases a compound ovulary is produced with one or more cavities.

In the gymnosperms, which include the Strobilophyta or our common evergreens, the flower is of a more primitive type and is usually called a strobilus or cone. The carpels are not closed around the seeds, hence there is no ovulary, but the seeds are exposed as the name gymnosperm implies. The frequently cultivated Ginkgo tree is the lowest type of tree growing out of doors in our region and has leaves that remind one of the leaflets of a maiden-hair fern. It is the only tree we have that is completely flowerless. The stamens and carpels are borne in rosettes with the foliage leaves on dwarf branches which continue to grow from year to year, often for a long time. This condition is therefore similar to what is present in the tree ferns, the plant having no determinate axes of any kind.

Following a peculiar process known as the reduction division which takes place in the cells inside of the microsporangium, a considerable number of microspores are developed, four for each original cell. In nearly the same way, four megaspores, one of which survives, are usually produced in each ovule. The flowers are thus modified spore-bearing branches or shoots of determinate growth producing two kinds of reduction spores. The flowers are nonsexual organs and the tree itself is always a nonsexual plant called the sporophyte, although some of its parts may show secondary sexual characters and dimorphisms. It is nonsexual only in

the sense that no gametes (eggs and sperms) are produced directly. The microspores germinate and develop into the pollen grains and the megaspores into the so-called embryo sacs, or minute, parasitic, male and female gametophytes respectively, which are the real sexual generation. After pollination has taken place, which is simply the transfer of the pollen to the ovules or to the stigmas, a tube grows from the pollen grain into the female gametophyte. The two sperm cells produced in the pollen grain or in the pollen tube pass down the tube and one unites with the egg cell of the female gametophyte. This union of sperm and egg is called fertilization. The resulting cell which is the oospore germinates and gives rise to an embryo inside of the ovule, the whole finally constituting the body called the seed. In the Anthophyta, endosperm is produced in the seed by the union of the second sperm with two cells from the female gametophyte. This embryo in the seed is the sporophyte and after sprouting develops into the tree. The seed is produced inside of or in connection with the modified carpels and other contiguous parts, the whole being called the fruit. The fruits of our trees are of many types usually with some means for seed distribution, so that the seed with its little embryonic tree inside may be carried away from the parent plant to some other and perhaps more favorable environment. Here, if conditions are proper, it sprouts and begins its life as an independent individual. The whole process of flower, seed, and fruit production is exceedingly complex and requires close study and observation if one would know the more obscure activities going on during the life cycle of a tree.

KEY TO THE GENERA OF TREES IN THE SUMMER CONDITION

Based mainly on leaf and twig characters. The number following the generic name refers to the list number.

1. Foliage leaves with expanded blades, netted-veined. 8.
1. Foliage leaves needle-shaped, narrowly linear, subulate, or scale-like; conifers. 2.
1. Foliage leaves fan-shaped with dichotomous venation, a number on thick, wart-like, persistent dwarf branches. **Ginkgo.** (1).
2. With typical dwarf branches, persistent for more than one year. 3.
2. With feather-like dwarf branches, deciduous each year, the linear leaves spreading into 2 ranks, or very short. **Taxodium.** (2).
2. Without dwarf branches. 4.
3. Dwarf branches small, self-pruned, with 2-5 foliage leaves. **Pinus.** (7).
3. Dwarf branches thick, wart-like, persistent, with numerous deciduous leaves. **Larix.** (6).
4. Leaf buds scaly; leaves scattered. 5.
4. Leaf buds not scaly, naked; leaves opposite or whorled. 7.
5. Leaf scar on a sterigma, the twigs covered with scales representing the leaf bases. 6.
5. Leaf scar on the bark; twigs without scales; leaves flat. **Abies.** (5).
6. Leaves flat, those on the upper side of the twig much shorter than the lateral ones; trees. **Tsuga.** (4).
6. Leaves more or less 4-sided, spreading in all directions. **Picea.** (3).
7. Foliage leaves small, scale-like, appressed, opposite, 4-ranked, closely covering the twigs which are decidedly flattened and fan-like; leaves of two shapes, the dorsal and ventral broader and less acute than the lateral ones; scales of the carpellate cone 6-10, not peltate. **Thuja.** (8).

7. Foliage leaves small, scale-like, appressed, opposite, 4-ranked, usually long decurrent, on somewhat flattened branches; scales of the carpellate cone 4-6, the two middle fertile, not peltate.

Libocedrus. (9).

7. Foliage leaves small, scale-like, appressed, opposite, 4-ranked, closely covering the slightly flattened twigs which are not very fan-like; leaves nearly or quite similar; scales of the carpellate cone peltate.

Chamaecyparis. (10).

7. Foliage leaves of two types, scale-like and subulate, opposite or in threes; the scale-like leaves 4-ranked, appressed, causing the twigs to appear quadrangular, the subulate leaves spreading; one or both types of leaves on a plant; carpellate cone developing into a bluish-black, berry-like fruit.

Juniperus. (11).

— 8 —

8. Leaves alternate. 9.
8. Leaves opposite or whorled. 74.
9. Leaves simple. 10.
9. Leaves compound. 62.
10. Leaves pinnately veined or with a simple midrib. 11.
10. Leaves palmately veined or at least with 2 or more prominent side ribs coming from near the base of the blade. 53.
11. Leaves truncate or broadly emarginate; with complete stipular rings at the nodes. **Liriodendron.** (13).
11. Leaves entire. 12.
11. Leaves serrate, dentate, crenate, pinnatifid, or variously lobed. 25.
12. With stipular rings at each leaf node; leaves large.

Magnolia. (12).

12. Not with stipular rings. 13.
13. With thorns and milky sap. 14.
13. Without thorns; sap not milky. 15.
14. With thorns beside the axillary buds; leaves not tapering at the base, acute or even heart-shaped.

Maclura. (65).

14. With terminal thorns and some axillary thorns; leaves tapering to the base; narrow or slender-cuneate.

Bumelia. (24).

15. Leaves evergreen, coriaceous, some on wood of the previous season. 16.

15. No leaves on wood of the previous season. 17.

16. Leaves green on both sides, thick, coriaceous, oblong to oblanceolate, 5-10 in. long; winter buds very scaly.

Rhododendron. (21)

16. Leaves green on both sides, or glaucous beneath, coriaceous, 2-5 in. long; oval or oval-lanceolate, winter buds naked. **Kalmia.** (22).

16. Leaves bright green above, paler beneath, coriaceous, 4-5 in. long, pointed at both ends; bark aromatic.

Persca. (15).

17. Pith with prominent diaphragms but solid; vascular bundles in base of petiole 3-7. 18.

17. Pith not both diaphragmed and solid, but sometimes with lenticular cavities. 19.

18. Leaves 2-ranked; bark with fetid odor; vascular bundles in base of petiole 5-7. **Asimina.** (14).

18. Leaves not 2-ranked; vascular bundles in base of petiole 3. **Nyssa.** (79).

19. Leaves resin-dotted, waxy-dotted or punctate, oblong, lanceolate, spatulate, or oblanceolate, short-pointed, narrowed at the base. **Myrica.** (75).

19. Leaves not dotted nor punctate. 20.

20. Pith prominently 5-angled; leaves with deciduous stipules and with bristle tips. **Quercus.** (66).

20. Pith cylindrical or nearly so; leaves not bristle-tipped. 21.

21. Leaves with the upper 2 lateral veins more or less parallel with the midrib. **Cornus.** (80).

21. Leaves pinnately veined to the tip. 22.

22. Bundle scar central; pith sometimes diaphragmed with lenticular cavities. 23.

22. Bundle scars 2 or more; pith without lenticular cavities. 24.

23. Leaves truncate or short-pointed at the base, usually widest below the middle or somewhat oblong,

- glabrous when mature; fruit a large pulpy berry, very astringent when green. **Diospyros.** (25).
23. Leaves pointed at the base, widest above the middle, lower surface pubescent; fruit a nut-like drupe. **Symplocos.** (26).
24. With prominent deciduous stipules; bark not resinous. **Cydonia.** (38).
24. Without stipules; bark resinous, aromatic. **Cotinus.** (56).

— 25 —

25. Lateral veins from the midrib straight and parallel or nearly so; some or all lateral veins usually ending in the serrations, teeth or lobes. 26.
25. Lateral veins not straight and parallel. 37.
26. Leaves not 2-ranked. 27.
26. Leaves of normal twigs quite regularly 2-ranked, that is with the third leaf over the first. 30.
27. Pith 3-angled, buds stalked. **Alnus.** (72).
27. Pith 5-angled, buds not stalked. 28.
27. Pith cylindrical or nearly so. 29.
28. Leaves or their lobes bristle-tipped, or if not bristle-tipped then the teeth or lobes not sharply acuminate; buds clustered at the tip of the twig; nut in a cup-like involucre of numerous scales. **Quercus.** (66).
28. Leaves with sharply acuminate teeth; buds not clustered at the tip; nuts with a prickly or spiny involucre. **Castanea.** (67).
29. Usually with prominent and typical lateral thorns; carpels of the pome bony. **Crataegus.** (40).
29. Without thorns but sometimes with thorn-like stunted branches; leaves irregularly dentate, serrate or crenate-dentate; sometimes lobed; pome fleshy without grit cells; carpels papery or leathery. **Malus.** (36).
29. Without thorns; leaves serrate or serrate-dentate; pome berry-like, carpels not bony. **Amelanchier.** (39).
30. Leaves decidedly inequilateral at the base. 31.

30. Leaves not inequilateral or only very slightly so. 32.
31. Axillary buds prominently stalked; leaves repand-dentate. **Heamamelis.** (57).
31. Buds sessile; leaves doubly serrate, bark not scaling off in plates. **Ulmus.** (62).
31. Buds sessile; leaves serrate, bark scaling off in plates like in the Sycamore. **Planera.** (61).
32. Lateral veins ending in the large dentations or serrations which are always simple (a vein for each). 33.
32. Leaves doubly serrate or sometimes simply serrate, the lateral veins ending in the main serrations or teeth but in the smaller ones, or the veins not ending in the serrations. 34.
33. Leaves ovate or ovate-oblong, short acuminate; teeth not with slender points; bark smooth, light gray.
Fagus. (68).
33. Leaves oblong-lanceolate, acuminate, with slender often inwardly curved points on the serrations; bark rough.
Castanea. (67).
34. Lateral veins not ending in the serrations or teeth.
Amelanchier. (39).
34. Lateral veins ending in some of the serrations, teeth or lobes. 35.
35. Bark smooth, the trunk and larger branches with fluted or projecting, muscle-like ridges; leaves acute or acuminate, sharply double serrate; nuts small, in a large-bracted catkin. **Carpinus.** (69).
35. Trunk and larger branches not with fluted or projecting ridges. 36.
36. Bark of trunk and larger branches separating into papery or leathery sheets; trees or shrubs with glabrous, pubescent, or glandular warty twigs.
Betula. (71).
36. Bark of trunk scaly, fine furrowed; twigs glandular-bristly; carpellate catkin in fruit appearing like that of the hop. **Ostrya.** (70).
36. Bark scaling off in plates like in the Sycamore; fruit coriaceous, nut-like. **Planera.** (61).

— 37 —

37. Leaves 2-ranked. 38.
37. Leaves not 2-ranked. 39.
38. Bark of trunk and larger branches separating into papery or leathery sheets; leaves doubly serrate, the lateral veins ending in the main serrations, teeth or lobes.

Betula. (71).

38. Bark not in papery or leathery sheets; leaves not doubly serrate, the lateral veins not ending directly in the serrations or teeth. **Amelanchier.** (39).
39. Leaves not with spines. 40.
39. Leaves evergreen, with spine-tipped lobes.

Ilex. (48).

40. Pith not solid, diaphragmed, with lenticular cavities. 41.
40. Pith solid but with prominent diaphragms; vascular bundles 3 in the base of the petiole. **Nyssa.** (79).
40. Pith solid, without diaphragms. 42.
41. Leaves oval or obovate, serrate or denticulate, abruptly acuminate, wedge-shaped at the base, more or less stellate pubescent beneath; bark of twigs peeling off in slender shreds; fruit 4-winged.

Halesia. (27).

41. Leaves oblong or slightly obovate, acute or acuminate at both ends, crenate-serrate or repand, short petioled; twigs of the season and lower surface of leaves pubescent, not stellate; fruit a nut-like drupe.

Symplocos. (26).

42. Leaves with peltate scales, or resin-dotted, oblanceolate or wedge-lanceolate. **Myrica.** (75).
42. Leaves not peltate scaly, nor resin-dotted. 43.
43. Outer bud scales of winter buds more than 1. 44.
43. Outer bud scale 1; twigs with brittle zones, hence easily detached and leaving peculiar self-pruning scars; terminal bud of ripe branches absent; bundle scars or vascular bundles in base of petiole. 3.

Salix. (77).

44. Pith decidedly 5-angled. 45.
44. Pith cylindrical or nearly so. 46.
45. Bundle scars 3; leaves with gland-tipped teeth, usu-

- ally broad-based, usually with 2 prominent glands at the base of the blade. **Populus.** (76).
45. Bundle scars several, scattered; leaves without glands; buds clustered at the tip of the twig. **Quercus.** (66).
46. With stipules or stipular scars. 47.
46. Without stipules or stipular scars; leaves sour, with prominent scattered hairs on the midrib beneath; fruit a capsule. **Oxydendrum.** (23).
47. With typical lateral thorns; fruit a drupe-like pome with bony ripe carpels. **Crataegus.** (40).
47. Not with typical lateral thorns, but some may have thorn-like stunted branches. 48.
48. Leaves with 1 or more disc-like, wart-like, or tooth-like glands on the petiole or at the base of the blade. 49.
48. Leaves not with distinct glands on the top of the petiole nor at the base of the blade, but they may be glandular-hairy. 50.
49. Twigs green, red, or red and green; nectar glands disc-like, usually 2-4 near the base at the edge of the blade; terminal bud present; fruit a velvety drupe. **Amygdalus.** (34).
49. Glands various; twigs not red and green, some with cleavage planes in basal joints; terminal bud present or absent, fruit a smooth drupe. **Prunus.** (33).
50. Axillary buds usually superposed; leaves lanceolate or oblong-lanceolate, tapering towards the short petiole; fruit a berry-like drupe. **Ilex.** (48).
50. Axillary buds not superposed. 51.
51. Leaves with gland-tipped serrations; terminal bud absent on ripe twigs or if present then the lateral veins prominent and nearly parallel and curving upward at the margin of the leaf; fruit, a berry-like drupe. **Rhamnus.** (46).
51. Leaves not with gland-tipped serrations or if so then not as above; terminal bud present; fruit a pome. 52.
52. Leaves sharply and regularly serrate, glabrous when mature, petioles long; pome with grit cells. **Pyrus.** (37).

52. Leaves irregularly dentate or serrate, or more or less lobed; pome without grit cells. **Malus.** (36).

— 53 —

53. Base of petiole covering the axillary bud; twigs with stipular rings. **Platanus.** (59).
53. Axillary buds usually evident; twigs without stipular rings. 54.
54. Leaves on normal twigs 2-ranked. 55.
54. Leaves not 2-ranked. 60.
55. Leaves entire, round-heart-shaped. **Cercis.** (43).
55. Leaves serrate, dentate, or lobed. 56.
56. Pith usually in transverse plates; leaves ovate-lanceolate, inequilateral, taper-pointed. **Celtis.** (60).
56. Pith solid, not diaphragmed. 57.
57. With milky sap. 58.
57. Without milky sap. 59.
58. Twigs gray or brown, glabrous or nearly so; leaves pubescent or glabrous beneath. **Morus.** (63).
58. Twigs grayish-green, downy; leaves tomentose beneath. **Broussonetia.** (64).
59. Leaves not inequilateral; vascular bundles in base of petiole 3. **Betula.** (71).
59. Leaves inequilateral at the base; vascular bundles in base of petiole several, scattered. **Tilia.** (20).
60. Leaves more or less star-shaped, with 3-7 long pointed serrate lobes, strongly aromatic when crushed; pith 5-angled. **Liquidambar.** (58).
60. Leaves entire or three-lobed, bark spicy-aromatic; internodes very unequal. **Sassafras.** (16).
60. Leaves crenate, serrate, dentate, or lobed, not star-shaped and not spicy-aromatic. 61.
61. Pith 5-angled; trees usually with resinous buds; leaves usually broad based. **Populus.** (76).
61. Pith cylindrical or nearly so; usually with prominent typical thorns. **Crataegus.** (40).

— 62 —

62. Pith diaphragmed, with cavities; large trees with pinnate leaves. **Juglans.** (74).

62. Pith not diaphragmed. 63.
63. Leaves trifoliate, odd-pinnate or odd-bipinnate. 64.
63. Leaves evenly pinnate or bipinnate; axillary buds superposed. 73.
64. Lobes or teeth at the base of the leaflets with prominent green glands beneath; leaves pinnate, very large with disagreeable odor. **Ailanthus**. (19).
64. Lobes or teeth if present without green glands. 65.
65. Leaflets glandular punctate; pith not 5-angled; small trees or shrubs. 66.
65. Leaflets not punctate. 67.
66. Leaves pinnate, with stipular spines.
Zanthoxylum. (17).
66. Leaves trifoliate, without stipular spines; bark with disagreeable odor; axillary buds superposed, covered by the petiole base. **Ptelea**. (18).
67. Base of petiole covering the axillary buds, or if not, the petioles and stems prickly; sometimes with stipular spines. 68.
67. Base of petiole not covering the axillary buds; not spiny or prickly. 70.
68. Leaflets entire. 69.
68. Leaflets serrate or dentate, simply pinnate; pith very large; bark resinous or milky. **Rhus**. (54).
68. Leaves serrate, bipinnate; petioles and stems prickly.
Aralia. (78).
69. Leaflets mucronate, usually obtuse; with stipular spines; base of petiole solid. **Robinia**. (45).
69. Leaflets abruptly acute; without stipular spines; base of petiole covering the buds like a cap.
Cladrastis. (44).
70. Leaflets entire or if occasionally few-toothed then the rachis prominently winged. 71.
70. Leaflets serrate, dentate, or lobed, the rachis not winged. 72.
71. Leaflets decidedly inequilateral, obliquely lanceolate or falcate, acuminate. **Sapindus**. (50).
71. Leaflets not inequilateral or only slightly so, not slender falcate, the rachis winged; twigs pubescent.
Rhus. (54).

71. Leaflets not inequilateral or only slightly so, not slender falcate; rachis not winged; twigs glabrous.
Toxicodendron. (55).
72. Pith 5-angled; stipules none, base of petiole with numerous vascular bundles, scattered or in 3 areas.
Carya. (73).
72. Pith not 5-angled; stipules none; leaflets more or less lobed; vascular bundles in base of petiole scattered; terminal bud absent. **Koelreuteria.** (51).
72. Pith cylindrical or nearly so; leaves with stipules; vascular bundles in base of petiole 3-5.
Sorbus. (35).
73. Pith small; base of petiole covering the axillary buds; usually with prominent thorns.
Gleditsia. (42).
73. Pith very large, base of petiole not covering the axillary buds; without thorns. **Gymnocladus.** (41).

—74—

74. Leaves simple. 78.
74. Leaves compound. 75.
75. Leaves digitate with 5 or more leaflets.
Aesculus. (52).
75. Leaves trifoliate or pinnate. 76.
76. Base of petiole covering the axillary buds; leaflets dentate, lobed, or nearly entire. **Acer.** (53).
76. Base of petiole not covering the axillary buds. 77.
77. Leaves trifoliate; bark with strong odor; terminal bud self-pruned. **Staphylea.** (49).
77. Leaflets 5-13; terminal bud present. **Fraxinus.** (30).
78. Leaves pinnately veined. 82.
78. Leaves palmately veined or at least with 2 prominent side ribs from the base. 79.
79. Leaves entire or if somewhat 3-lobed with entire margin. 80.
79. Leaves serrate, crenate, dentate or variously lobed. 81.
80. Pith diaphragmed, or with large cavities; petioles usually hollow; axillary buds superposed.
Paulownia. (31).

80. Pith and petioles solid; axillary buds not superposed; under side of leaves with glands in the axils of the large veins. **Catalpa.** (32).
81. Leaves more or less lobed; fruit a 2-winged samara.
Acer. (53).
81. Leaves not lobed; fruit a drupe. **Rhamnus.** (46).
82. Leaves serrate, dentate, crenate, or variously lobed. 83.
82. Leaves entire. 85.
83. Bark of ripe twigs green, bundle scar or vascular bundle in base of petiole 1; pith rhombic.
Euonymus. (47).
83. Bark of ripe twigs gray, brown, or red; pith cylindrical or nearly so. 84.
84. Axillary buds sometimes superposed; leaves finely denticulate; twigs light brown, sometimes thorny; drupe narrowly oblong. **Forestiera.** (29).
84. Axillary buds not superposed; twigs not 4-angled, brown; flowers epigynous; fruit a fleshy drupe; vascular bundles in the base of petiole 3.
Viburnum. (83).
84. Axillary buds not superposed; leaves serrate with stipules, small; bundle scar central; twigs brown, sometimes with thorns; shrub-like trees with drupe-like berries. **Rhamnus.** (46).
85. Leaves coriaceous, evergreen, hence on wood of the previous season. **Kalmia.** (22).
85. Leaves deciduous each year. 86.
86. Leaves with two outer lateral veins more or less parallel with the midrib. 87.
86. Leaves pinnately veined to the tip. 88.
87. Axillary buds not covered by the petiole base; inflorescence cymose. **Cornus.** (80).
87. Axillary buds minute, hidden by the petiole base; flowers in involucrate heads. **Cynoxylon.** (81).
88. Stipules none; fruit an oblong drupe.
Chionanthus. (28).
88. Stipules present; fruit dry, in a head.
Cephalanthus. (82).

KEY TO THE GENERA OF TREES IN THE WINTER CONDITION

Based mainly on twig stem characters. The number following the generic name refers to the list number.

1. Foliage leaves persistent and usually evergreen. 2.
1. Foliage leaves deciduous each year. 11.
2. Foliage leaves needle-shaped, subulate, narrowly linear, or scale-like; conifers. 3.
2. Foliage leaves with expanded blades, netted veined. 8.
3. With dwarf branches, each bearing 2-5 foliage leaves.
Pinus. (7).
3. Without true dwarf branches. 4.
4. Leaf buds scaly. 5.
4. Leaf buds not scaly, naked. 7.
5. Leaf scar not on a sterigma, prominent, circular; leaves flat. **Abies.** (5).
5. Leaf scar on a sterigma, the base of the leaf remaining as a scale on the twig. 6.
6. Leaves flat, those on the upper side of the twig much shorter than the lateral ones. **Tsuga.** (4).
6. Leaves more or less 4-sided, spreading in all directions.
Picea. (3).
7. Foliage leaves small, scale-like, appressed, opposite, 4-ranked, closely covering the twigs which are decidedly flattened and fan-like; leaves of two shapes, the dorsal and ventral broader and less acute than the lateral ones; scales of the carpellate cone not peltate. **Thuja.** (8).
7. Foliage leaves small, scale-like, appressed, opposite, 4-ranked, usually much elongated, on somewhat flattened branches; scales of the carpellate cone 4-6, the two upper fertile, not peltate.
Libocedrus. (9).
7. Foliage leaves small, scale-like, appressed, opposite, 4-ranked, closely covering the slightly flattened twigs which are not very fan-like; leaves nearly or quite similar; scales of the carpellate cone peltate.
Chamaecyparis. (10).

7. Foliage leaves of two types, scale-like and subulate, opposite or in threes; the scale-like leaves 4-ranked, appressed, causing the twigs to appear quadrangular, the subulate leaves spreading; one or both types of leaves on a plant; carpellate cone developing into a bluish-black, berry-like fruit.
Juniperus. (11).
8. Leaves with spine-tipped lobes or teeth. **Ilex.** (48).
8. Leaves without spines. 9.
9. Leaves pubescent at least below, lanceolate, mucronate, not evergreen; buds clustered at the tip of the twig; trees with 5-angled pith. **Quercus.** (66).
9. Leaves glabrous below; pith not 5-angled. 10.
10. Leaves green on both sides, thick, coriaceous, oblong to oblanceolate, 5-10 in. long; winter buds very scaly.
Rhododendron. (21).
10. Leaves green on both sides or glaucous beneath, coriaceous, 2-5 in. long, oval to oval-lanceolate; winter buds naked; erect shrubs. **Kalmia.** (22).
10. Leaves bright green above, paler beneath, coriaceous, 4-5 in. long, pointed at both ends; bark aromatic.
Persea. (15).

— 11 —

11. Twigs with thick wart-like dwarf branches; gymnosperms. 12.
11. Twigs without true dwarf branches. 13.
12. Young twigs covered with scales. **Larix.** (6).
12. Twigs without scales. **Ginkgo.** (1).
13. Twigs with numerous small scattered self-pruning scars, without apparent leaf scars but with minute dry scale leaves, with feather-like dwarf branches, some usually remaining in winter; roots often with knees; a conifer.
Taxodium. (2).
13. Twigs with evident leaf scars and lateral winter buds. 14.
14. Leaf scars alternate. 15.
14. Leaf scars opposite or whorled. 72.
15. Twigs with distinct and complete stipular ridges or rings at the leaf nodes. 16.
15. Twigs without complete stipular rings. 18.

16. Leaf scar surrounding the axillary bud, terminal bud self-pruned; wood with prominent medullary rays.

Platanus. (59).

16. Leaf scar not surrounding the axillary bud, terminal bud not self-pruned; buds enclosed in the large connate stipules. 17.

17. Buds glabrous; twigs brown; pith diaphragmed; leaf scars oval or circular; bark spicy-aromatic.

Liriodendron. (13).

17. Buds downy, or if glabrous then the twigs red; pitch with or without diaphragms; leaf scars U-shaped, oval, or circular; bark usually aromatic.

Magnolia. (12).

18. With thorns, prickles, or spines; or with spur-like branches ending in thorns. 19.

18. Without thorns, prickles or spines, but some may have thorn-like stunted branches. 26.

19. With stipular spines, a pair for each leaf scar. 20.

19. Twigs with typical lateral thorns, without terminal thorns. 21.

19. With thorns at the ends of branches or with spur-like branches ending in thorns, and in addition axillary thorns may be present. 22.

19. Stems or twigs with prickles; leaf scar extending nearly around the stem, with about 20 bundle scars; pith large. **Aralia.** (78).

20. Leaf scar covering the two or more superposed axillary buds. **Robinia.** (45).

20. Leaf scar below the axillary buds; buds reddish, pubescent. **Zanthoxylum.** (17).

21. With thorns beside the axillary buds; normally one for each leaf axil, becoming gradually smaller toward the tip of the twig, terminal bud absent.

Maclura. (65).

21. Thorns axillary, large, rarely branched except on the main trunk; usually with two lateral buds at the base which may develop as twigs; numerous axils without thorns. **Crataegus.** (40).

21. Thorns commonly branched, situated above the axil of the leaf; leaf scar covering the two or more superposed axillary buds; twigs polished, often zigzag. **Gleditsia.** (42).
22. Not with three distinct bundle scars. 23.
22. With three bundle scars. 24.
23. Buds and twigs glabrous or nearly so; with few thorns. **Rhamnus.** (46).
23. Buds and sometimes twigs pubescent or downy; thorns prominent. **Bumelia.** (24).
24. Terminal bud self-pruned; twigs some shade of black, brown, or reddish. **Prunus.** (33).
24. Terminal bud present. 25.
25. Buds conical, pungent, pubescent, twigs glabrous or nearly so, mostly yellow-olive; trees with erect growth the branches not spreading as in most of the apples. **Pyrus.** (37).
25. Buds downy or pubescent, twigs usually pubescent, if glabrous then dark reddish-brown; trees with rounded crowns and spreading branches. **Malus.** (36).

— 26 —

26. Leaf scars quite regularly 2-ranked, that is with the third scar over the first. 27.
26. Leaf scars not 2-ranked. 38.
27. Terminal bud present. 28.
27. Terminal bud absent, the twig showing a terminal self-pruning scar at the morphological tip. 31.
28. Terminal bud naked, prominently stalked or elongated and silky. 29.
28. Terminal bud with dry scales, not stalked nor silky. 30.
29. Terminal bud not stalked, silky; pith diaphragmed, solid. **Asimina.** (14).
29. Terminal bud prominently stalked, tomentose; pith not diaphragmed; twigs zigzag. **Hamamelis.** (57).
30. Medullary rays not prominent; visible bud scales few; bundle scars 3. **Amelanchier.** (39).

30. Medullary rays very prominent; visible bud scales numerous; bundle scars more than 3. **Fagus.** (68).
30. Medullary rays not prominent; visible bud scales 2; bundle scar 1. **Diospyros.** (25).
31. Pith interruptedly diaphragmed, with cavities, small, greenish-white. **Celtis.** (60).
31. Pith solid. 32.
32. Twigs dark reddish-brown, speckled, often zigzag; buds reddish-violet, often superposed or clustered. **Cercis.** (43).
32. Twigs not speckled as above but the pith 5-angled. **Castanea.** (67).
32. Twigs not speckled; pith cylindrical or nearly so. 33.
33. Medullary rays very prominent in tangential section; winter buds usually long pointed with several to many dry scales. **Fagus.** (68).
33. Medullary rays very prominent; winter buds rather fleshy, usually with 1-3 visible scales. **Tilia.** (20).
33. Medullary rays inconspicuous. 34.
34. Bundle scars more than 3, definitely scattered. 35.
34. Bundle scars 3, or if more than the petiole base with a double abscission, a small joint abscissed from the projecting petiole base and exposing more than 3 bundle scars. 36.
35. Visible bud scales more than 3; twigs glabrous or pubescent but not downy. **Morus.** (63).
35. Visible bud scales 1-3; twigs downy, grayish-green; bark very fibrous. **Broussonetia.** (64).
36. Bark smooth, trunk and large branches with peculiar fluted or projecting ridges; bud scales brown, finely pubescent; staminate catkins in the bud in winter; with double abscission in the petiole base. **Carpinus.** (69).
36. Trunk not with fluted or projecting ridges. 37.
37. Bark of trunk scaling off like in the Sycamore; twigs very slender; no catkins. **Planera.** (61).
37. Bark in rough ridges; no catkins; twigs and buds in most cases pubescent; some species with charac-

teristic transverse self-pruning scars on the twigs, others with corky ridges. **Ulmus.** (62).

37. Bark scaly, fine-furrowed, the furrows usually somewhat spiral; bud scales green with brown tips, nearly glabrous; twigs glandular-bristly; staminate catkins exposed in winter; with double abscission in the petiole base. **Ostrya.** (70).
37. Bark of trunk and larger branches separating into papery or leathery sheets; catkins in winter.

Betula. (71).

— 38 —

38. With 2 or more superposed axillary buds; all except 1 may be very small. 39.
38. Axillary buds single or 2 or more side by side; not superposed. 46.
39. Pith diaphragmed, with air cavities. 40.
39. Pith diaphragmed but solid; bundle scars 3; stipular scars none. **Nyssa.** (79).
39. Pith not diaphragmed, solid. 41.
40. Pith large, brown; twigs thick, with large leaf scars and 3 prominent bundle scars. **Juglans.** (74).
40. Pith rather small, white or greenish; leaf scars semi-circular; outer bud scales about 2. **Halesia.** (27).
41. Buds partly sunken, hardly projecting beyond the surface or if so pith very large; terminal bud self-pruned or tips of branches withering. 42.
41. Buds not sunken in the epidermis. 43.
42. Leaf scar not surrounding the axillary buds; pith large, chocolate-colored; twigs robust, polished, mottled white and purplish-brown.
- Gymnocladus.** (41).
42. Leaf scars not surrounding the buds; pith large, white or brown; twigs brown, not mottled, pubescent.
- Ailanthus.** (19).
42. Leaf scar surrounding the axillary buds, quadrangular U-shaped; bark with pungent odor; pith white.
- Ptelea.** (18).
42. Leaf scar covering the axillary buds; pith small; twigs brown, polished, often zigzag. **Gleditsia.** (42).

53. With polished, greenish-brown, grayish-yellow, or red twigs; bark sour; leaf scar prominent, semi-oval, with a dark central scar usually in the form of a ring; buds small, not projecting much beyond the epidermis; the large terminal paniced raceme with capsules persisting all winter.

Oxydendrum. (23).

53. With 2 visible scales in the triangular flattened bud; pith sometimes with cavities; twigs pubescent or glabrous; zigzag at the tip. **Diospyros.** (25).

— 54 —

54. Outer bud scales more than 1. 55.
 54. Outer bud scale 1; twigs usually with brittle zones and hence very easily detached; stipular scars present; bundle scars 3; pith small. **Salix.** (77).
 55. Pith diaphragmed but solid; bundle scars 3; no stipular scars. **Nyssa.** (79).
 55. Pith not diaphragmed. 56.
 56. Pith more or less 5-angled. 57.
 56. Pith cylindrical or nearly so. 61.
 57. Buds clustered at the tip of the twig; bundle scars numerous, scattered. **Quercus.** (66).
 57. Buds not clustered at the tip. 58.
 58. Bundle scars numerous usually scattered. 59.
 58. Bundle scars 3. 60.
 59. Buds small with about 3 outer scales; twigs reddish or yellowish-brown, glabrous or pubescent; terminal bud present or absent; stipular scars prominent.
Castanea. (67).
 59. Terminal bud large with 4 or more visible scales, hairy or peltate pubescent; lateral buds usually superposed; twigs tough. **Carya.** (73).
 60. Without stipular or self-pruning scars; crushed buds fragrant, aromatic, not resinous, glabrous.
Liquidambar. (58).
 60. Stipular and self-pruning scars present; crushed buds not fragrant though they may have a resinous odor, resinous or if only slightly so then the twigs pubescent or tomentose. **Populus.** (76).

61. Pith very large, light brown, bark not resinous, ill-smelling; buds spherical or flattened at the apex, often clustered at the tip of the twig, brown and pubescent; bundle scars about 9 along the lower edge of the very large leaf scar; large trees.

Ailanthus. (19).

61. Pith small, or if large and brown then the bark resinous. 62.
 62. Bark with a resinous or sticky milky sap; pith usually large, if rather small then the bark aromatic. 63.
 62. Bark not resinous. 64.
 63. Buds clustered at the tip of the twig; bark spicy-fragrant to the smell; base of petiole prominent with several bundle scars; fruiting panicles plumose.

Cotinus. (56).

63. Buds not clustered at the tip; bark, often very poisonous to the touch; leaf scar partly surrounding the bud; small trees or shrubs.

Toxicodendron. (55).

64. Terminal bud absent. 65.
 64. Terminal bud present. 68.
 65. Stipules or stipular scars absent or indistinct. 66.
 65. Stipules or stipular scars present. 67.
 66. Buds clustered at the tip of the twig; young twigs glandular dotted. **Myrica.** (75).
 66. Buds not clustered at the tip; twigs not glandular; bundle scars 3. **Prunus.** (33).
 66. Buds not clustered at the tip; twigs not glandular; bundle scars numerous; outer bud scales 2.

Koelreuteria. (51).

67. Buds and twigs very downy, twigs dark brown or black.

Cydonia. (38).

67. Buds downy or pubescent; twigs glabrous or pubescent, gray or brown. **Rhamnus.** (46).
 68. Twigs green or yellowish-green, glabrous; internodes very unequal; lateral buds minute; small trees.

Cornus. (80).

68. Twigs normally red above and green beneath, glabrous; bark very bitter; some axils with 2 or 3 hairy buds of nearly equal size; trees. **Amygdalus.** (34).

68. Twigs not green or red and green unless the plants are low shrubs, but gray, brown, black, or reddish. 69.
 69. Bundle scars 5 or more in the broad U-shaped leaf scar; tips of the buds quite downy; small trees.

Sorbus. (35).

69. Bundle scars 3. 70.
 70. Buds rounded at the apex, often clustered at the tip of the twig; twigs glandular dotted. **Myrica.** (75).
 70. Buds rounded at the apex; scales thick; twigs often zigzag; plant usually with some thorns, not glandular dotted. **Crataegus.** (40).
 70. Buds pointed; plants sometimes with thorn-like stunted branches, not glandular dotted. 71.
 71. Buds glabrous or slightly pubescent; twigs usually glabrous and slender, some shade of black, brown, or reddish, often with 2 or 3 axillary buds; some with self-pruning scars. **Prunus.** (33).
 71. Buds long-pointed, the scales rather thick; twigs somewhat pubescent; leaf scars narrow, contracted between the bundle scars. **Amelanchier.** (39).
 71. Buds downy or strongly pubescent, conical, pungent; twigs glabrous, mostly yellow-olive; trees with erect growth, the branches not spreading as in most of the apples. **Pyrus.** (37).
 71. Buds downy or strongly pubescent; twigs strongly pubescent or if glabrous then dark reddish-brown; trees with rounded or spreading crowns.

Malus. (36).

71. Buds and twigs very pubescent; terminal bud with long spreading scales; shrubs or small trees with globose berry-like drupes containing 2-4 stones.

Rhamnus. (46).

— 72 —

72. Bundle scars 1, or several closely united in a curved line, appearing as 1. 74.
 72. Bundle scars more than 1 but not in an ellipse or ring. 78.
 72. Bundle scars numerous, in an ellipse or ring; buds small and flat or superposed, pith large. 73.

73. Pith with cavities or more or less diaphragmed; axillary buds superposed. **Paulownia**. (31).
73. Pith solid; axillary buds small and flat, not superposed, leaf scars often in threes. **Catalpa**. (32).
74. Twigs very green, more or less 4-angled; pith diamond-shaped or rhomboidal. **Euonymus**. (47).
74. Twigs not green when ripe but gray, brown or red, sometimes 4-angled; pith cylindrical or nearly so. 75.
75. Terminal bud absent, the twig usually ending in a thorn. **Rhamnus**. (46).
75. Terminal bud present unless the twig is fruiting. 76.
76. Axillary buds often superposed; twigs often with thorns; leaf scars small. **Forestiera**. (29).
76. Axillary buds not superposed; no thorns on the twigs; leaf scars rather large. 77.
77. Twigs and buds pubescent; lateral buds cylindrical or heimspherical; bud scales dry; leaf scar concave, on the short petiole base; lenticles large and conspicuous; fruit a drupe. **Chionanthus**. (28).
77. Buds rough or pubescent; twigs glabrous or pubescent, sometimes 4-angled; lateral buds somewhat flattened, obtuse; bud scales rather dry; leaf scar close to the bark; lenticles not large; fruit a samara.
- Fraxinus**. (30).
77. Axillary buds minute and sunken; twigs glabrous or pubescent; stipules dry, prominent; or with prominent stipular scars. **Cephalanthus**. (82).
78. With 4 distinct stipular scars; terminal bud self-pruned; twigs green with strong odor.
- Staphylea**. (49).
78. Without definite stipular scars; twigs not green or if so then the terminal bud present. 79.
79. Trees or shrubs with numerous bundle scars, sometimes in 3 areas, in a large heart-shaped leaf scar; pith rather large; terminal bud large, with numerous scales. **Aesculus**. (52).
79. Bundle scars 3 or sometimes 5. 80.
80. Terminal bud with 2 long acuminate pubescent outer scales; line connecting the uppermost leaf scars notched. 81.

80. Terminal bud with one main pair of visible scales and a smaller pair at the base. **Viburnum.** (83).
80. Terminal bud with several pairs of visible scales; bundle scars 3-5; twigs sometimes green. **Acer.** (53).
81. Axillary buds usually minute and undeveloped except at the base of the peduncle which is self-pruned; twigs green or reddish-green, glabrous or nearly so. **Cynoxylon.** (81).
81. Axillary buds normally well developed and prominent; twigs often very pubescent. **Cornus.** (80).

GENERAL KEY TO THE FAMILIES AND GENERA

Based on the flower and other characters present at the time of blooming. The number following the generic name refers to the list number.

1. Ovules naked on an open carpel; pollen falling directly on the micropyle of the ovule which is mostly without a pollen-chamber; trees or shrubs; ours usually evergreen with narrow leaves; monocious, rarely dicocious. 2.
1. Ovules in a closed carpel or set of carpels provided with a stigma for the reception of the pollen; flowers more commonly showy. 4.
2. Leaves fan-shaped, dichotomously veined, on thick wart-like dwarf branches; dicocious trees. **GINKGOACEAE.**

a. **Ginkgo.** (1).

2. Leaves not fan-shaped and dichotomously veined, but needle-shaped, narrowly linear, subulate or scale-like. 3.
3. Leaf buds naked or minute; carpels few, spiral; leaves on feather-like dwarf branches which are deciduous. **TAXODIACEAE.**

a. **Taxodium.** (2).

3. Leaf-buds naked; carpels few, opposite, sometimes forming a black or blue berry-like fruit; leaves opposite or whorled, rarely scattered, persistent. **JUNIPERACEAE.**

- a. Carpellate cones oblong, the scales not peltate. b.
- a. Carpellate cones globose or nearly so, the scales peltate, or forming a bluish berry-like fruit. c.
- b. Cone scales 6-10, the upper fertile. **Thuja.** (8).
- b. Cone scales 4-6, the 2 upper fertile.

Libocedrus. (9).

- c. Cone with dry peltate scales; ovules usually 2.

Chamaecyparis. (10).

- c. Cone becoming blue and fleshy; twigs not flattened; leaves or some of them often subulate.

Juniperus. (11).

3. Leaf-buds scaly; carpels usually numerous; leaves spirally arranged, the foliage leaves often situated on dwarf branches. **PINACEAE.**
- a. Without dwarf branches. b.
 - a. With dwarf branches. d.
 - b. Leaf scar on a sterigma, the twigs covered with scales representing the leaf bases. c.
 - b. Leaf scars on the bark; twigs without scales; leaves usually flat; carpellate cones erect.
- Abies.** (5).
- c. Leaves more or less 4-sided, spreading in all directions; carpellate cones pendulous. **Picea.** (3).
 - c. Leaves flat, those on the upper side of the twig much shorter than the lateral ones; carpellate cones small, pendulous. **Tsuga.** (4).
 - d. Leaves deciduous, numerous on thick, wart-like dwarf branches. **Larix.** (6).
 - d. Leaves needle-shaped, persistent, 2-7 on small self-pruned dwarf branches. **Pinus.** (7).

— 4 —

- 4. Leaves mostly parallel-veined, sometimes netted-veined; parts of the flower very often in threes (trimerous); cotyledon 1; the closed vascular bundles scattered through the pith, usually not in a circle; no annual rings of growth. No trees in our region. **MONOCOTYLAE.**
- 4. Leaves usually netted-veined; parts of the flower more commonly in fives (pentamerous) or fours (tetramerous); cotyledons usually 2; vascular bundles usually in a circle around a central pith, forming annual rings of growth in perennial stems, with bark on the outside. 5.

5. DICOTYLAE.

- 5. Perianth none or of similar segments or divided into calyx and corolla; corolla when present choripetalous (petals distinct), sepals, petals and stamens sometimes on a disk or hypanthium. 6.

5. Perianth composed of calyx and corolla, calyx may be minute or suppressed; corolla sympetalous (petals more or less united). 39.
6. Calyx and corolla both present, calyx may be minute. 7.
6. Only the calyx present, sepals distinct or united green or colored; or perianth none. 25.
7. Flowers hypogynous or perigynous; ovulary free or only slightly adherent to the perigynous disk or hypanthium. 8.
7. Flowers epigynous or apparently epigynous; calyx above the ovulary, with or without an hypanthium. 24.
8. Stamens numerous, at least more than 10 and more than twice the petals. 9.
8. Stamens not more than twice as many as the petals, when of just the number as the petals then alternate with them. 12
8. Stamens of the same number as the petals and opposite them; ovulary 2-5-locular, calyx 4-5-cleft, valvate in the bud; petals involute; fruit a drupe or capsule; shrubs, small trees, or vines with simple leaves. RHAMNACEAE.

a. **Rhamnus.** (46).

9. Carpels 1 or more, united, but styles and stigmas may be several. 10.
9. Carpels more than 1, distinct; filaments shorter than the anthers; perianth trimerous; leaves 2-ranked.

ANONACEAE.

a. **Asimina.** (14).

9. Carpels numerous spirally arranged and cohering over each other, forming an aggregate cone-like fruit; trees; sepals and petals in threes; twigs with stipular rings.

MAGNOLIACEAE

- a. Anthers introrse; leaves not truncate.

Magnolia. (12)

- a. Anthers extrorse; leaves truncate.

Liriodendron. (13).

10. Ovulary compound plurilocular. 11.
10. Ovulary unilocular, 2-ovuled; leaves usually with disk-like or tooth-like glands on the petiole or at the base of the blade. ROSACEAE. (Amygdalatae).

- a. Young ovulary and drupe glabrous.

Prunus. (33).

- a. Young ovulary and drupe velvety-pubescent.

Amygdalus. (34).

11. Flower cluster subtended by a large, membranous bract; calyx deciduous; leaves alternate 2-ranked; sap mucilaginous. **TILIACEAE.**

a. **Tilia.** (20).

11. Flowers not subtended by a membranous bract; leaves alternate with deciduous stipules; sepals persistent. **ROSACEAE. (MALATAE).**

See 24 below.

12. Ovulary only 1, carpels 1 to many, united. 15.
 12. Carpels 2 or more, distinct, or somewhat united at the base. 13.
 13. Leaves compound. 14.
 13. Shrubs or trees with alternate simple leaves. **HAMAMELIDACEAE.**
 a. Ovules 1 in each cavity; leaves inequilateral, not star-shaped. **Hamamelis.** (57).
 a. Ovules several in each cavity, fruit globular, spiny. **Liquidambar.** (46).
 14. Leaves punctate with pellucid dots, alternate. **RUTACEAE.**

a. **Zanthoxylum.** (17).

14. Leaves large, pinnate, alternate, not punctate but with disk-like glands under the teeth or lobes. **SIMARUBACEAE.**

a. **Ailanthus.** (19).

15. Carpel 1, ovulary with 1 parietal placenta; leaves alternate, usually with stipules; usually compound. **FABACEAE.**

- A. Upper petal inclosed by the lateral ones in the bud; leaves simple or compound mostly with stipules. **CASSIATAE.**

- a. Leaves simple, flowers bisporangiate.

Cercis. (43).

- a. Leaves compound, flowers diecious or imperfectly diecious. b.

- b. Stamens 3-5; pith small; usually with thorns. **Gleditsia.** (42).
- b. Stamens 10; pith large, chocolate-colored; without thorns. **Gymnocladus.** (41).
- B. Upper petal inclosing the lateral ones in the bud; leaves compound (sometimes with 1 leaflet) with stipules. **FABATAE.**
 - a. Without stipular spines; leaflets large, 3-6 in. long; base of petiole covering the axillary buds like a cap. **Cladrastis.** (44).
 - a. With stipular spines; leaflets small, 1-2 in. long; base of petiole not covering the axillary buds like a cap, but solid. **Robinia.** (45).
- 15. Carpels more than 1 as shown by the compound ovulary cavities, placentae, styles, or stigmas. 16.
- 16. Ovulary 2-locular to pluriocular. 17.
- 16. Ovulary 1-locular, ovules solitary, stigmas 3; shrubs or trees with resinous or milky sap and alternate leaves without stipules. **ANACARDIACEAE.**
 - a. Leaves compound; style terminal. b.
 - a. Leaves simple; style lateral. **Cotinus.** (56).
 - b. Petiole base covering the axillary buds, or if not then the rachis wing-margined; not poisonous. **Rhus.** (54).
 - b. Petiole base not completely covering the axillary buds, the rachis not wing-margined; poisonous to the touch; glabrous; leaflets entire. **Toxicodendron.** (55).
- 17. Flowers regular or nearly so. 18.
- 17. Flowers irregular; shrubs or trees with opposite digitate leaves; ovulary 3-locular. **AESULACEAE.**
 - a. **Aesculus.** (52).
- 17. Flowers irregular in the number of the several floral sets; leaves pinnate or bipinnate, alternate; ovulary 3-locular. **SAPINDACEAE.**
 - a. **Koelreuteria.** (51).
- 18. Stamens neither just as many nor twice as many as the petals. 19.

18. Stamens just as many or twice as many as the petals. 20.
19. Stamens distinct and fewer than the 4 petals; trees or shrubs with opposite pinnate or simple leaves. OLEACEAE.
a. Flowers diecious, from catkin-like scaly buds.

Forestiera. (29).

- a. Flowers bisporangiate petals linear.

Chionanthus. (28).

19. Stamens more numerous than the petals; leaves palmately veined, opposite; fruit 2-winged. Some ACERACEAE.

a. **Acer.** (53).

20. Ovules 1 or 2 in each cavity. 21.
20. Ovules several or many in each cavity; stipules between the opposite and pinnately compound leaves, caducous; shrubs or small trees. STAPHYLEACEAE.

a. **Staphylea.** (49).

21. Leaves palmately veined, or compound. 22.
21. Leaves pinnately veined, simple, not punctate. 23.
22. Leaves pinnately compound, alternate; ours trees with a globose or lobed berry. SAPINDACEAE.

a. **Sapindus.** (50).

22. Leaves palmately veined or pinnately compound; trees or shrubs with opposite leaves and no stipules. ACERACEAE.

a. **Acer.** (53).

22. Leaves 3-foliate, pellucid-punctate, without stipules. Some RUTACEAE.

a. **Ptelea.** (18).

23. Calyx minute; trees or shrubs with simple mostly alternate leaves. ILICACEAE.

a. **Ilex.** (48).

23. Calyx not minute; trees, shrubs, or woody climbers; ours with opposite leaves and with minute fugaceous stipules. CELASTRACEAE.

a. **Euonymus.** (47).

— 24 —

24. Perfect stamens 4, styles 2; leaves alternate, palmately veined and lobed, or if pinnately veined then 2-ranked. HAMAMELIDACEAE.

See 13 above.

24. Stamens 5, 10 or many; styles 2-5; leaves alternate with stipules. ROSACEAE. (MALATAE).

a. Leaves pinnate. **Sorbus.** (35).

a. Leaves simple. b.

b. Cavities of the ovary as many as the styles. c.

b. Cavities of the ovary becoming twice as many as the styles. **Amelanchier.** (39).

c. Ovules many in each cavity (carpel).

Cydonia. (38).

c. Ovules 1-3 in each cavity of the ovary. d.

d. Usually with typical thorns; ripe carpels bony.

Crataegus. (40).

d. Without thorns, but some may have thorn-like stunted branches; ripe carpels papery or leathery. e.

e. Leaves sharply and regularly serrate, glabrous when mature, petioles long; pome with grit cells.

Pyrus. (37).

e. Leaves irregularly dentate or serrate, or more or less lobed; pome without grit cells. **Malus.** (36).

24. Stamens 4 or 5, style and stigma 1; leaves opposite or alternate. CORNACEAE.

a. Ovary 2-locular, flowers bisporangiate. b.

a. Ovary 1-locular, flowers diecious or imperfectly diecious. **Nyssa.** (79).

b. Flowers cymose, not involucre. **Cornus.** (80).

b. Flowers capitate, with an involucre of 4-6 large white bracts. **Cynoxylon.** (81).

24. Stamens 4 or 5 on a flat disk which covers the 3-5-locular ovary; shrubs or trees with opposite leaves and minute fugaceous stipules. CELASTRACEAE.

See 23 above.

24. Stamens 5, styles usually 2-5; leaves bipinnate. ARALIACEAE.

a. **Aralia.** (78).

— 25 —

25. Leaves opposite. 26.
 25. Leaves alternate. 27.
 26. Stamens 5-8; leaves palmately veined and simple or if pinnately compound then the base of the petiole covering the axillary buds. ACERACEAE.

a. **Acer.** (53).

26. Stamens 2-4; leaves pinnately veined when simple, or if pinnately compound then the axillary buds exposed. OLEACEAE.

- a. Flowers fasciculate or racemose-fasciculate not from prominent scaly buds; leaves compound.

Fraxinus. (30).

- a. Flowers fasciculate, from scaly buds; leaves simple.

Forestiera. (29).

27. At least the staminate flowers in catkins or catkin-like spikes or spherical heads. 31.
 27. Flowers not in catkins or catkin-like spikes or heads. 28.
 28. With prominent stipular spines; leaves punctate with glands. RUTACEAE.

a. **Zanthoxylum.** (17).

28. Without stipular spines. 29.
 29. Styles or stigmas 3 or 4; perigynous stamens, 4-5, alternate with the sepals; ovulary 2-5-locular, ovules solitary in each cavity. RHAMNACEAE.

a. **Rhamnus.** (46).

29. Styles or stigmas 2; leaves 2-ranked; ovulary 1-2-ovuled; stipules fugaceous. ULMACEAE.
 a. Flowers in clusters on twigs of the previous season; pith not diaphragmed. b.
 a. Flowers on elongated twigs of the season; pith interruptedly diaphragmed. **Celtis.** (60).
 b. Flowers expanding before the leaves; bark in rough ridges. **Ulmus.** (62).

- b. Flowers expanding with the leaves; bark of trunk scaling off like in the Sycamore. **Planera.** (61).
- 29. Style and stigma 1. 30.
- 30. Calyx 6-parted; stamens and staminodes about 12 in 4 series; bark spicy-aromatic. **LAURACEAE.**
 - a. Flowers bisporangiate, paniced; leaves evergreen. **Persea.** (15).
 - a. Flowers monosporangiate, racemose or umbellate; leaves deciduous, some of them lobed. **Sassafras.** (16).
- 30. Calyx 5-parted; stamens 10 or fewer; bark not aromatic. **FABACEAE. (CASSIATAE.)**
 - See 15 above.
- 30. Calyx 5-parted; stamens 5-15; flowers epigynous; pith solid but diaphragmed. **CORNACEAE.**
 - a. **Nyssa.** (79).
- 31. Twigs with complete stipular rings; base of petiole covering the axillary bud; flowers monocious, in dense heads. **PLATANACEAE.**
 - a. **Platanus.** (59).
- 31. Twigs without stipular rings. 32.
- 32. Axillary buds superposed; staminate flowers in flexible catkins; leaves pinnately compound. **JUGLANDACEAE.**
 - a. Pith solid. **Carya.** (73).
 - a. Pith diaphragmed, with cavities. **Juglans.** (74).
- 32. Axillary buds not superposed or if so then the staminate flowers not in flexible catkins; leaves simple. 33.
- 33. Carpellate flowers epigynous; pith solid, with diaphragms. **CORNACEAE.**
 - a. **Nyssa.** (79).
- 33. Carpellate flowers hypogynous or perigynous; pith not diaphragmed. 34.
- 34. Staminate and carpellate flowers in dense spherical heads, sap not milky; leaves star-shaped, fragrant when crushed. **HAMAMELIDACEAE.**
 - a. **Liquidambar.** (58).
- 34. Staminate and carpellate flowers not in dense spherical heads unless the sap is milky; leaves not star-shaped. 35.

35. With milky sap; leaves with two prominent lateral veins from the base or if not then the twigs thorny. **MORACEAE**.
- a. Twigs with thorns; carpellate perianth deeply 4-cleft carpellate flowers capitate. **Maclura**. (65).
 - a. Twigs without thorns. b.
 - b. Staminate and carpellate flowers in ament-like spikes. **Morus**. (63).
 - b. Staminate flowers racemose or spicate the carpellate capitate. **Broussonetia**. (64).
35. Sap not milky. 36.
36. Both staminate and carpellate flowers in aments, the carpellate flowers not subtended by a bur or cup. 37.
36. Carpellate flowers not in aments, subtended by a cup or involucre; staminate flowers in flexible or somewhat capitate aments. **FAGACEAE**.
- a. Staminate flowers capitate, ovulary 3-angled.
Fagus. (68).
 - a. Staminate flowers in slender aments. b.
 - b. Carpellate flowers 2-5 in each involucre, which becomes prickly. **Castanea**. (67).
 - b. Carpellate flower 1 in each involucre, which consists of numerous scales. **Quercus**. (66).
37. Ovulary 1-locular, many seeded; seeds with a tuft of cottony hairs. **SALICACEAE**.
- a. Stamens numerous; bracts fimbriate or entire, buds with several exposed scales; pith 5-angled.
Populus. (76).
 - a. Stamens 2-10; bracts entire; buds with 1 outer scale. **Salix**. (77).
37. Ovulary 1-2 locular, with 1-2 ovules in each cavity; seeds not with cottony hairs. 38.
38. Carpellate flowers single in the axils of the bracts; young twigs and leaves glandular dotted; buds clustered at the tip of the twig. **MYRICACEAE**.
- a. **Myrica**. (75).
38. Carpellate flowers 2 or more in each bract of the ament; twigs and leaves not glandular dotted; buds not clustered at the tip of twig. **BETULACEAE**.

- a. Pith 3-angled; buds stalked; leaves not 2-ranked; stamens 4. **Alnus.** (72).
- a. Pith not 3-angled; buds sessile; leaves 2-ranked. b.
- b. Staminate flowers 3-6 in the axil of each bract, with a calyx; carpellate flowers without a calyx; stamens 2. **Betula.** (71).
- b. Staminate flowers solitary in the axil of each bract, without a calyx; carpellate flower with a calyx. c.
- c. Fruiting bract flat, 3-cleft and incised; bark smooth; trunk and large branches with peculiar fluted or projecting ridges. **Carpinus.** (69).
- c. Fruiting bract bladder-like, closed; bark of older trunks scaly and fine-furrowed. **Ostrya.** (70).

— 39 —

- 39. Flowers hypogynous (ovulary superior). 40.
- 39. Flowers epigynous (ovulary inferior). 44.
- 40. Stamens free from the corolla (or only very slightly united at the base) as many as the petals (flowers tetracyclic) and alternate with them, or twice as many (pentacyclic) or more. 41.
- 40. Stamens united with the corolla, as many as the petals and opposite them or twice as many or more. 42.
- 40. Stamens united with the corolla, the fertile ones fewer than the petals and alternate with them. 42.
- 41. Sympetalous trees or shrubs often with evergreen leaves without stipules. **ERICACEAE.**
 - a. Leaves deciduous in autumn; flowers in panicle racemes; leaves sour, with long bristles on the midrib beneath. **Oxydendrum.** (23).
 - a. Leaves evergreen coriaceous. b.
 - b. Corolla somewhat irregular, campanulate, without little sacs. **Rhododendron.** (21).
 - b. Corolla regular, saucer-shaped. 10-saccate, the anthers at first held in the little sacs. **Kalmia.** (22).
- 41. Choripetalous plants in which the petals are sometimes partly or completely united.

- a. Ovulary 1-locular (1 carpel) with 1 parietal placenta.
FABACEAE.

See 15 above.

- a. Ovulary 4-8-locular, with 1 or 2 ovules in each cavity.
ILICACEAE.

See 23 above.

42. Stamens as many as the lobes of the small white corolla;
leaves entire, simple and alternate; with thorns. SAPO-
TACEAE.

a. **Bumelia.** (24).

42. Stamens twice as many as the lobes of the greenish-
yellow corolla or more; styles 2-8; plants mostly
monocious or diccious; leaves alternate, simple, and
entire. EBENACEAE.

a. **Diospyros.** (25).

43. Flowers regular, stamens usually 2. OLEACEAE.

a. **Chionanthus.** (28).

43. Flowers irregular, zygomorphic; seeds numerous, stamens
2-4, didynamous. BIGNONIACEAE.

a. Pith with cavities; stamens 4. **Paulownia.** (31).

a. Pith solid; stamens 2. **Catalpa.** (32).

44. Stamens twice as many as the lobes of the corolla or
more; leaves alternate and simple. 45.

44. Stamens as many as the lobes of the corolla; leaves
opposite or whorled, simple. 46.

45. Corolla yellow; stamens in several series. SYMPLOCACEAE.

a. **Symplocos.** (26).

45. Corolla white; stamens in one series. STYRACACEAE.

a. **Halesia.** (27).

46. Stipules present; flowers in dense heads in our species;
usually blackening in drying. RUBIACEAE.

a. **Cephalanthus.** (82).

16. Usually without stipules; flowers in compound cymes in
our species; not blackening in drying. CAPRIFOLIACEAE.

a. **Viburnum.** (83).

CLASSIFICATION AND DESCRIPTION OF THE SPECIES.

SPERMATOPHYTA. SEED-PLANTS.

Phylum, CYCADOPHYTA.

Class, GINKGOAE.

Order, GINKGOALES.

Ginkgoaceae. Ginkgo Family.

1. *Ginkgo* Kaempfer Ginkgo.

Trees with dichotomously veined, fan-shaped leaves on thick, wart-like, persistent, dwarf branches.

Without cones. Stamens and carpels in clusters on the dwarf branches, appearing with the leaves.

1. *Ginkgo biloba*. L. Maiden-hair-tree. A large beautiful and hardy dioecious tree. Seed large, drupe-like. Autumn leaves orange. Introduced from China and Japan; should be commonly cultivated for ornament.

Phylum, STROBILOPHYTA.

Class, CONIFERAE. Conifers.

Order, PINALES.

Taxodiaceae. Bald-cypress Family.

2. *Taxodium* Rich. Bald-cypress.

Trees with feather-like, annually deciduous (ours) dwarf branches with the numerous, small, narrow leaves sometimes spreading into two ranks or closely oppressed, and having the slender twigs covered with small self-pruning scars

Tall trees with horizontal or drooping branches; monoecious; carpellate cones globose, in small terminal clusters; their scales few, each with two ovules at the base.

1. Leaves on dwarf branches linear, spreading into 2 ranks. *T. distichum*.

1. Leaves on dwarf branches awl-shaped, short, closely appressed. *T. ascendens*.

1. **Taxodium distichum** (L.) Rich. Bald-cypress. A large tree, the old bark flaky in thin strips. The roots develop upright conic "knees." Wood light, soft, brown and very durable. In swamps and along rivers. N. J. to Fla., west to Tex., north to Mo. and Ind.

2. **Taxodium ascéndens** Brong. Pond-cypress. A large tree similar to the preceding, with a greatly enlarged, conoidal, broadly ridged base but with fewer "knees." Wood heavier and stronger than in the Bald-cypress. In ponds and swamps. Southern Va. to Fla. and La.

Pinaceae. Pine Family.

3. **Picea** Link. Spruce.

Evergreen trees with 4-angled leaves, all of about the same length, having the twigs covered with sterigma-bearing scales representing leaf bases.

Conical trees with leaves spirally arranged and spreading in all directions; monocious; staminate and carpellate cones often highly-colored; carpellate cones pendulous.

1. Twigs and sterigmata glabrous; carpellate cones cylindric. 2.

1. Twigs pubescent, brown; carpellate cones ovoid or oval. 3.

2. Leaves usually $\frac{3}{4}$ -1 in. long; carpellate cones $2\frac{1}{2}$ -6 in. long. *P. abies*.

2. Leaves usually not much over $\frac{1}{2}$ in. long; very glaucous; carpellate cones $\frac{3}{4}$ -2 in. long. *P. glauca*.

3. Leaves not glaucous; cones deciduous at the end of the first season. *P. rubra*.

3. Leaves glaucous; cones persistent for two or more seasons. *P. mariana*.

1. **Picea ábies** (L.) Karst. Norway Spruce. A large tree, conical in shape when young, with numerous stout spreading and drooping branches. Amundant in cultivation. Source of Burgundy pitch. Native of Europe.

2. **Picea glaùca** (Moench) Voss. White Spruce. (*P. canadensis* (Mill.) B. S. P.) A slender tree sometimes with a strong skunk-like odor. Leaves light green, slender, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, very acute. An important timber tree with light,

soft, weak, and straight-grained wood. Newf. to Alaska, south to Me., Mich., and S. Dak.

3. *Picea rubra* (DuRoi) Deitr. Red Spruce. A slender tree with spreading branches, and slender, sparingly pubescent twigs. Wood soft, weak and pale reddish. Newf. to northern N. Y. and Minn.; along the Alleghenies to Va. and Ga.

4. *Picea mariàna* (Mill.) B. S. P. Black Spruce. A tree with spreading branches and smooth or only slightly roughened bark. Leaves not over $\frac{3}{8}$ in. long, stout, green, closely covering the twigs. Wood light and straight-grained; used for paper pulp, for general lumber and for masts and spars of ships. Newf. to N. W. Terr., south to N. J., N. C., Mich. and Minn.

4. *Tsùga* Carr. Hemlock.

Evergreen trees with flat linear leaves, those on the top of the twig short, and having the twigs covered with sterigma-bearing scales representing leaf bases.

Branches slender, horizontal or drooping; leaves spreading more or less into 2 ranks; monocious; carpellate cones small, pendulous.

1. *Tsuga canadensis* (L.) Carr. Hemlock. A tall tree with slender, horizontal or drooping branches, the old bark flaky in scales. Wood very coarse, light, brittle, and soft; used for wood pulp. Bark used for tanning. Source of Canada pitch. Self-prunes twigs. N. S. to Minn. south to Ohio, and Del., along the Alleghanies to Ala., and to Mich. and Wis.

5. *Abies* (Tourn.) Hill. Fir.

Evergreen trees with flat linear leaves, rarely prismatic, without sterigma-bearing scales, but with prominent circular leaf scars with a central bundle scar.

Carpellate cones erect, the scales deciduous; monocious; carpellate bract longer or shorter than the ovuliferous scale.

1. Carpellate bract aristate, longer than the ovuliferous scale; leaves mostly emarginate. *A. fraseri*.

1. Carpellate bract serrulate, shorter than the ovuliferous scale or but little longer; leaves obtuse. *A. balsamea*.

1. **Abies fraseri** (Pursh) Poir. Fraser Fir. A slender tree growing on the high Alleghanies. Bark smooth, with resin blisters. W. Va., N. Car., and Tenn.

2. **Abies balsamea** (L.) Mill. Balsam Fir. A slender short-lived tree with smooth blistered bark. Wood very light and soft. Canada balsam is obtained from its resin. Newf. to Hudson Bay and Alberta, south to Penn., along the Alleghanies to Va., and to Mich., Iowa, and Minn.

6. **Larix** (Tourn.) Adans. Larch.

Trees with thick wart-like dwarf branches bearing a cluster of deciduous needle-shaped leaves.

Tall pyramidal, monocious trees with horizontal or ascending branches; carpellate cones small, erect, with thin woody scales.

1. Carpellate cones small, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, oval or almost globular; ovuliferous scales glabrous; native, grow in bogs and wet places. *L. laricina*.

1. Carpellate cones rather large $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long; ovuliferous scales finely tomentose on the back, cultivated in dry ground. *L. decidua*.

1. **Larix laricina** (DuRoi) Koch. Tamarack. A slender tree with close or at length scaly bark. Wood hard, durable, and very strong; used in ship-building, for railroad ties, posts, and telegraph poles. In swamps and about the margins of lakes. Newf. to N. W. Terr., south to Minn., Ind., Ohio, and N. J.

2. *Larix decidua* Mill. European Larch. A beautiful tree with horizontal branches and drooping branchlets, conical in shape when young; much cultivated in some parts of the United States. The source of Venice turpentine. Native of Europe.

7. **Pinus** (Tourn.) L. Pine.

Evergreen trees with self-pruned dwarf branches bearing 1-7 needle-shaped leaves.

Resinous, monocious trees with very small dwarf branches; dwarf branches and ordinary twigs covered with scale leaves. Dwarf branches self-pruned after a number of years. Carpellate cones woody with numerous carpels. Our most important lumber trees.

1. Dwarf branches with 5 foliage leaves; ovuliferous scales little thickened at the tip. *P. strobilus*.
1. Dwarf branches with 2-3 foliage leaves; ovuliferous scales much thickened at the tip. 2.
2. Dwarf branches with 3 foliage leaves, rarely 2 or 4. 3.
2. Dwarf branches mostly with 2 foliage leaves; some of them may be with 3. 5.
3. Leaves 6-10 in. long; carpellate cone oblong-conic or ovoid. 4.
3. Leaves 3-5 in. long; carpellate cones ovoid. *P. rigida*.
4. Old sheaths of the dwarf branches $\frac{3}{4}$ -1 in. long; leaves not glaucous; carpellate cones oblong-conic. *P. taeda*.
4. Old sheaths about $\frac{1}{2}$ in. long; leaves glaucous; carpellate cones ovoid. *P. serotina*.
5. Twigs glaucous; resin-ducts parenchymatous; carpellate cones $1\frac{1}{2}$ -3 in. long; ovuliferous scales with a prickle or small spine. 6.
5. Twigs not glaucous. 7.
6. Leaves slender, $2\frac{1}{2}$ -5 in. long; buds not very resinous; prickles of the ovuliferous scales short and small. *P. echinata*.
6. Leaves stout, $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long; buds very resinous; prickles of the ovuliferous scales long and stout. *P. virginiana*.
7. Leaves 1-4 in. long, grayish-green or light green; ovuliferous scales without or with a small prickle, or with a thick point or spine. 9.
7. Leaves 4-6 in. long, dark-green; ovuliferous scale without a spine or prickle, or sometimes with a very small prickle. 8.
8. Foliage lustrous, resin ducts peripheral; carpellate cones terminal or subterminal, oval-conic; ovuliferous scales pointless when mature. *P. resinosa*.
8. Foliage dull; resin ducts parenchymatous; carpellate cones lateral, ovoid-conic; ovuliferous scale with a small prickle. *P. nigra*.
9. Leaves $2\frac{1}{2}$ -4 in. long, grayish-green; twigs orange or brown; resin ducts parenchymatous; carpellate cones ovoid; 3-5 in. long. *P. pungens*.
9. Leaves $\frac{1}{2}$ - $2\frac{1}{2}$ in. long. 10.

10. Leaves $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long, grayish-green; twigs dull greenish-yellow or greenish-brown; resin ducts peripheral; carpellate cones ovate-conic, 2-3 in. long. *P. silvestris*.
10. Leaves $\frac{1}{2}$ - $1\frac{1}{2}$ in. long; resin ducts parenchymatous; carpellate cones oblong-conic 1-2 in. long, usually upwardly curved. *P. banksiana*.

1. **Pinus stròbus** L. White Pine. A large tree with nearly smooth bark, except when old; branches horizontal in whorls. Often forming dense forests. Wood soft and straight-grained; used in enormous quantities for building purposes. One of the most valuable timber trees in the world. Has been more extensively used in America for lumber than any other tree. Newf. to Man., south along the Allegh. to Ga. and to Ohio, Ill. and Iowa.

2. **Pinus resinòsa** Ait. Red Pine. A tall tree with reddish bark. Wood rather hard but not very durable. Turpentine is obtained to a limited extent from this species. A tree of rapid growth. Newf. to Man., Mass., Penn., and Minn.

3. *Pinus nigra* Arn. Austrian Pine. A tall open, pyramidal tree of rapid growth with the thick spreading branches in regular whorls. Often cultivated. From Europe.

4. *Pinus silves'tris* L. Scotch Pine. A large and valuable tree with drooping branches; much cultivated. From it are obtained the red and yellow deal much used as lumber in Europe. Native of northern Europe.

5. **Pinus taèda** L. Loblolly Pine. A large tree of very rapid growth with spreading branches and thick, rugged bark, flaky in age. Wood rather hard; much used for lumber in the South. Often growing in old fields. N. J. to Fla., Ark., and Texas.

6. **Pinus serótina** Mx. Pond Pine. A tree usually with a short trunk and with the bark fissured into small plates. In swamps and ponds. Wood soft, brittle, and coarse-grained. Coastal plain. N. J. to Fla.

7. **Pinus rígida** Mill. Pitch Pine. A tree with spreading branches, the old bark rough and furrowed, flaky in strips. Sprouts readily from the stump if cut down or burned. Wood rather hard and brittle and full of resin; used for fuel,

charcoal, and coarse lumber. A source of turpentine to a limited extent. In dry, sandy or rocky soil. N. B. to Ont., Tenn., Ohio, W. Va. and Ga.

8. ***Pinus banksiana*** Lamb. Jack Pine. A slender tree with spreading branches, the bark becoming flaky. Wood light and rather soft. In sandy soil. N. B. and N. W. Terr., south to Me., N. Y., Ill., and Minn.

9. ***Pinus echinata*** Mill. Shortleaf Yellow Pine. A large tree with spreading branches; leaves sometimes in 3's, sometimes in 2's. Wood rather hard and very valuable; much used as lumber. Also furnishes some turpentine. Produces shoots from stumps. In sandy soil. N. Y. to Fla., Ohio, Ill., Okla., and Texas.

10. ***Pinus pungens*** Lamb. Table-mountain Pine. A tree with spreading branches, the old bark rough and in flakes; leaves sometimes in 3's. Wood light and soft; much used for charcoal. N. J. to Ga. and Tenn.

11. ***Pinus virginiana*** Mill. Scrub Pine. A slender, usually small tree with spreading or drooping branches; the old bark flaky and dark-colored. Wood very resinous, soft and durable but of poor quality. In sandy soil. L. I. to S. C., Ala., Tenn., Ohio, and Ind.

Juniperaceae. Juniper Family.

Subfamily, *Cupressatae*.

8. ***Thuja*** L. Arborvitae.

Evergreen trees or shrubs with decidedly flattened and fan-like twigs, and with naked buds, the small leaves opposite, scale-like, appressed and 4-ranked; carpellate cone oblong, with 6-10 scales, the 4 upper fertile.

Resinous and aromatic; flowers minute, monocious; ovules usually 2 on each scale, erect; scales dry coriaceous, not peltate.

1. Branchlets spreading more or less horizontally with a distinct upper and lower side; carpellate cones pendulous, the thin scales appendiculate below the apex; seeds winged. *T. occidentalis*.

1. Branchlets in a vertical plane with both sides alike; carpellate cones erect, the scales with a prominent

horn-like process below the apex; seeds wingless.
T. orientalis.

1. ***Thuja occidentalis* L.** American Arborvitae. Usually a small conical tree with fan-like branches. Self-prunes twigs. Wood light and durable; used for posts, railroad ties, etc. Usually in wet soil and along the banks of streams. N. B. to Man., south to Ohio and N. J., along the Alleghanies to N. C., and to Ill. and Minn.

2. *Thuja orientalis* L. Chinese Arborvitae. A small pyramidal or bushy tree with spreading and ascending branches. Native of Asia. Cultivated in many forms. Probably better regarded as belonging to a distinct genus, *Biota* Endl.—*B. orientalis* (L.) Endl.

9. ***Libocèdrus* Endl.** Incense-cedar.

Evergreen trees with naked buds and small, scale-like, appressed, opposite, 4-ranked, usually long decurrent leaves on somewhat flattened branches; scales of the carpellate cone 4-6, the two middle ones fertile, not peltate.

Tall, resinous aromatic trees with scaly bark, monocious; staminate and carpellate cones on separate branchlets; seeds with unequal lateral wings.

1. *Libocedrus decurrens* Torr. Incense-cedar. A tree with a tall, straight slightly lobed trunk, tapering from a broad base. Wood light, soft, close-grained, and very durable in contact with the soil. From the Pacific coast; often cultivated as an ornamental tree.

10. ***Chamaecýparis* Spach.** White-cedar

Evergreen trees with small, scale-like appressed, nearly or quite similar leaves, naked buds, and dry peltate carpellate scales with 2-4 seeds.

Monocious; carpellate cones globose, with thick, opposite scales, each with a central* point.

1. Leaves dull blue-green; bark thin, divided into flat ridges. *C. thyoides*.

1. Leaves bright green; bark thick, divided into broad ridges. *C. lawsoniana*.

1. **Chamaecyparis thyoides** (L.) B. S. P. Southern White-cedar. A tree with soft, light, and durable wood; used for boat-building, woodenware, shingles, etc. In swamps. Maine to N. H., N. J., Fla., and Miss.

2. *Chamaecyparis lawsoniana* (Murr.) Parl. Lawson Cypress. A large tree with an abruptly enlarged base and a spire-like crown of small horizontal or pendulous branches. Bark often 10 in. thick. Wood light, hard, and strong, abounding in fragrant resin. From the Pacific coast. Many varieties in cultivation.

Subfamily, *Juniperatae*.

11. **Juniperus** L. Juniper.

Evergreen trees or shrubs with naked buds, subulate or scale-like leaves, one or both kinds on a tree, and with carpellate cones developing into a bluish-black berry-like fruit.

Carpellate cones small, globose; plants usually deicious, sometimes monocious, pungent aromatic; bark usually thin and shreddy.

1. Leaves all subulate, prickly pointed, verticillate, slender, mostly straight; cones axillary. *J. communis*.

1. Leaves of 2 kinds, scale-like and subulate, opposite or verticillate; cones terminal. *J. virginiana*.

1. **Juniperus communis** L. Common Juniper. A low tree with spreading or drooping branches and shreddy bark. Goats are poisoned from eating the leaves. On dry hills. N. S. to Alaska, south to N. J., Ohio, Mich., Neb., and in the Rocky Mts. to N. Mex. Also in Europe and Asia.

2. **Juniperus virginiana** L. Red Juniper. A tree with spreading often irregular branches when old, but conic in shape when young. Self-prunes twigs. Wood very valuable, light, straight-grained, durable, and fragrant; used for posts, cabinet-work, interior finish, veneers, moth-proof chests and cooperage, and almost exclusively in the manufacture of lead pencils. Often infested with the "cedar apple." Poisonous to goats. In dry soil; common on bluffs. N. B. to western Ont. and S. Dak., south to Fla. and Texas.

Taxus baccata L. European Yew (Order, Taxales; Family, Taxaceae), becoming a large tree is sometimes planted.

It has fleshy drupe-like red fruits and minute staminate cones with peltate stamens, like the shrubby American Yew, *Taxus canadensis* Marsh.

Phylum, ANTHOPHYTA.

Class, DICOTYLAE. Dicotyls.

Subclass, THALAMIFLORAE.

Order, RANALES.

Magnoliaceae. Magnolia Family.

12. *Magnòlia* L. Magnolia.

Shrubs or trees with alternate, simple, entire leaves, not truncate, and with complete stipular rings.

Bark bitter aromatic; flowers bisprangiate, large, solitary; buds covered with connate, sheathing stipules; pith usually diaphragmed but solid; fruit aggregate, cone-like.

1. Leaves acute or rounded at the base. 2.
1. Leaves auriculate or cordate at the base. 4.
2. Leaves rounded or truncate at the base, thin. Leaf buds silky pubescent. *M. acuminata*.
2. Leaves acute at the base. 3.
3. Leaves light green beneath, 1-2 ft. long. Leaf buds glabrous. *M. tripetala*.
3. Leaves glaucous beneath, 3-6 in. long. Leaf buds pubescent. *M. virginiana*.
4. Leaves auriculate, glabrous. Leaf buds glabrous. *M. fraseri*.
4. Leaves cordate at the base, glaucous-white and pubescent beneath; leaf buds tomentose. *M. macrophylla*.

1. ***Magnolia acuminata*** L. Cucumber Magnolia. A large tree with silky pubescent leaf-buds. Leaves oval, acute or somewhat acuminate, rounded or truncate at the base, $\frac{1}{2}$ -1 ft. long; flowers greenish-yellow. Wood soft, light, and durable; used for cabinet-work, pump-logs, and water-troughs. N. Y. to Ontario and Mo., Ga., Ala., and Ark.

2. ***Magnolia tripetala*** L., Umbrella Magnolia. A low tree with glabrous leaf-buds and irregular branches. Leaves obovate, acute, cuneate at the base, 1-2 ft. long, flowers white, slightly odorous. Wood soft and light. Penn. to Ga., Mo., Ark., and Miss.

3. **Magnolia virginiana** L. Laurel Magnolia. A tree with pubescent leaf-buds. Leaves oval or oblong, acute at the base, 3-6 in. long; flowers white, deliciously fragrant. In swamps. Mass. to Penn., Fla., Ark., and Texas.

4. **Magnolia fraseri** Walt. Fraser Magnolia. A tree with spreading branches and glabrous leaf buds. Leaves elongated-obovate or oblong, auriculate, $\frac{1}{2}$ -2 ft. long; flowers white. In mountain woods. Va. and Ky. to Fla. and Miss.

5. **Magnolia macrophylla** Mx. Large-leaf Magnolia. A tree, sometimes branching near the base, with very large leaves, 1-3 $\frac{1}{2}$ ft. long, and pubescent twigs. Flowers large, $\frac{1}{2}$ -1 ft. in diameter, fragrant, white with a purple center; fruiting cone broadly oval, bright rose-colored at maturity. Heart-wood brown satiny, hard; sap-wood light yellow. In woods; southern Ohio to N. Car., Fla., Ark., and La.

Various Magnolias are in cultivation, the more common one is *Magnolia soulangiæna* Soul. Soulange's Magnolia, a small tree with large purplish-pink flowers appearing before the leaves.

13. **Liriodendron** L. Tuliptree.

Trees with alternate, truncate, simple leaves, with solid, diaphragmed pith and complete stipular rings.

Buds with connate stipules; flowers large, perianth trimerous; anthers linear, extrorse; fruit aggregate, cone-like, dry.

1. **Liriodendron tulipifera** L. Tuliptree. A very large magnificent, rapid-growing tree with glabrous leaf-buds. Flowers greenish-yellow, orange-colored within. Autumn leaves pure yellow. Next to the Sycamore, probably the largest tree in the Northeastern United States; trunk sometimes 34 feet in circumference. Wood light, soft, and straightgrained, easily worked; heart wood light yellow or brown; sapwood thin, nearly white. Used for interior finish, shingles, boat-building, panels of carriages, wooden pumps, wooden ware of various kinds, wood pulp, furniture, implements, boxes, shelving, drawers, and for carving and toys. One of the best woods for paneling. Should be extensively cultivated. Vt. and R. I. to Fla., Mich, Ark., and Miss.

Anonaceae. Custard-apple Family.14. *Asimina* Adans. Papaw.

Trees or shrubs with alternate, 2-ranked, simple, entire, pinnately veined, deciduous leaves and diaphraged, solid pith.

Buds naked, silky; bark with fetid odor; perianth trimerous; carpels 3-15.

1. *Asimina trifloba* (L.) Dunal. Papaw. A small tree or shrub with smooth dark bark and nodding young twigs. Flowers axillary, nodding; fruit a large, fleshy, oblong, greenish-yellow, edible berry, which, however, does not agree with some persons. A case of severe poisoning from eating the fruit is recorded. In creek and river bottoms and on hillsides. Ont. and N. Y. to Mich., Neb., Tex., and Fla.

Lauraceae. Laurel Family.15. *Pérsea* (Plum.) Gaertn. Bay.

Aromatic, evergreen trees or shrubs with alternate, simple, pinnately veined, entire leaves.

Perianth 6-parted; stamens and staminodes 12, in 4 series; fruit a globose or oblong berry.

1. *Persea borbônia* (L.) Spreng. Red Bay. A tree with red bark and lanceolate or oblong-lanceolate, puberulent or nearly glabrous leaves. Wood hard, strong, bright red in color, and rather brittle; used for cabinet-making and interior finish. Along streams and the border of swamps. Del. to Fla., Ark., and Texas.

16. *Sassafras* Nees and Eberm. Sassafras.

Trees with entire or 3-lobed, alternate leaves with 2 prominent lateral veins, with spicy aromatic bark and unequal internodes.

Flowers diecious; perianth 6-parted; fruit a blue drupe.

1. *Sassafras variifolium* (Salisb.) Ktz. Sassafras. A large rough-barked tree, the sap of the bark and leaves mucilaginous. Autumn leaves red, yellow, and green. Wood reddish, light and rather soft, of coarse texture, durable; used in cooperage, for small boats, and fencing. The bark of the roots yields a powerful, aromatic stimulant. Fruit pungent, poison-

ous. Excessive doses of Sassafras tea produce narcotic poisoning. In dry or sandy soil. Me. to Ont., Mich., Iowa, Fla., and Texas.

Order, GERANIALES.

Rutaceae. Rue Family.

17. *Zanthoxylum* L. Prickly-ash.

Trees or shrubs with alternate, pinnately compound, punctate leaves and with stipular spines.

Bark acrid aromatic; flowers imperfectly diecious; fruit a capsule with 1-2 seeds.

1. *Zanthoxylum americanum* Mill. Prickly-ash. A prickly shrub or small tree with small flowers in sessile axillary cymes; stamens 3-5; carpels 2-5 distinct, seed oblong black and shining. Wood soft and light brown. In woods and thickets. Quebec to Va., Ontario, S. Dak., and Kan.

18. *Ptelea* L. Hoptree.

Shrubs or small trees with alternate, trifoliolate, punctate leaves and superposed buds covered by the petiole base.

Bark bitter; flowers imperfectly monosporangiate; stamens 4-5; fruit a samara with a membranous wing; ovulary 2-locular.

1. *Ptelea trifoliata* L. Hoptree. A shrub or small tree with sunken superposed axillary buds covered by the petiole base. Bark and flowers with a disagreeable odor. Wood light brown, heavy, and hard. In woods. Conn. to Fla., Ont., Minn., Kan., and Mexico.

Simarubaceae. Ailanthus Family.

19. *Ailanthus* Desf. Ailanthus.

Large trees with alternate, pinnately compound, large leaves having green glands on the under side of the teeth at the base of the leaflets.

Branches robust with large brown pith; flowers diecious; the 5 samaras linear or oblong, usually twisted.

1. *Ailanthus altissima* (Mill.) Swingle. Tree-of-heaven. A large tree of rapid growth with thick branches and smooth bark. Leaves ill-scented; leaflets with green glands

under the lobes or teeth. Autumn leaves pure yellow. Wood hard and useful. Sprouts freely from the roots and is easily propagated from root cuttings. A pest in pastures in some states; cows will not eat grass near the young shoots. Water contaminated by the leaves is poisonous. Naturalized from China. Ont. to Mass., Va., and Kan.

Order, MALVALES.

Tiliaceae. Linden Family.

20. *Tilia* (Tourn.) L. Linden.

Trees with 2-ranked, simple palmately veined, inequilateral, serrate or dentate leaves and solid pith.

Flowers bisporangiate, pentamerous, stamens numerous; dry drupaceous fruit in cymose clusters, the peduncle subtended by a broad membranous bract.

1. Leaves glabrous or nearly so on both sides at maturity, except on the veins and in their axils. 2.
1. Leaves pubescent beneath at maturity. 3.
2. Petals with scales at the base; inflorescence without bracts; leaves comparatively large; native. *T. americana*.
2. Petals without scales at the base, inflorescence with large bracts; leaves comparatively small; cultivated. *T. europaea*.
3. Leaf blades with white, gray, or silvery-gray pubescence beneath or sometimes brownish in *T. heterophylla*. 4.
3. Leaf blades with brown or rusty pubescence beneath, smooth and shining above. *T. neglecta*.
4. Peduncle bracts mostly abruptly narrowed to the base of the peduncle; leaf blades ovate, gray or silvery beneath; obliquely truncate or slightly cordate at the base. *T. heterophylla*.
4. Peduncle bracts mostly gradually narrowed to the peduncle above the base; leaf blades longer and narrower than in the preceding species and obliquely cordate at the base. *T. michauxii*.

1. *Tilia americana* L. American Linden. Incl. *T. glabra* Vent. A large straight-trunked tree with spreading

branches. Inner bark very tough; used for mats and coarse rope. Wood soft and very white, light and uniform in texture, not liable to crack; called "basswood"; used for wooden-ware, cabinet-work, trunks, paneling of carriages, in cooperage, and for toys. The bark and wood of the other lindens are much the same. In rich soil, on bluffs, and along river bottoms. N. B. to Va., Manitoba, Kan., and Texas.

2. *Tilia europæa* L. European Linden. A large tree much cultivated in various varieties in parks. Its name, Lin, was the origin of the family name of Linnaeus.

3. *Tilia neglécta* Spach. Rusty-leaf Linden. A tall tree with furrowed and scaly, reddish-brown bark. Twigs glabrous; leaves acute or abruptly acuminate, smooth and shining above, covered below with short persistent pubescence and with conspicuous axillary tufts. Wood as in *T. americana*. In rich moist ground. Que., Mass., and N. Y. to N. Car., and Miss.

4. *Tilia heterophýlla* Vent. White Linden. A large tree with slender, glabrous twigs and with large ovate leaves, gray or silvery-gray beneath and with an obliquely truncate or slightly cordate base. Wood much as in the preceding. N. Y. to Fla., Ala., Ky., W. Va., and Ind.

5. *Tilia michauxii* Nutt. Michaux's Linden. A large tree with elongate-ovate leaves obliquely cordate at the base, the vein axils usually without axillary tufts. Wood with the same general characteristics as the other lindens. In rich soil. Conn. to Ind., Ga., Miss., Ark., Mo., and Ill.

Subclass, HETEROMERAE.

Order, ERICALES.

Ericaceae. Heath Family.

21. *Rhododéndron* L. Rhododendron.

Shrubs or small trees with simple, alternate, entire, pinnately veined, coriaceous, evergreen leaves and very scaly winter buds.

Flowers showy, bisporangiate, pentamerous, sympetalous; fruit usually a woody capsule with numerous seeds.

1. *Rhododendron máximum* L. Great Rhododendron.

A tall shrub or small tree with beautiful flowers and striking evergreen leaves. Leaves poisonous to stock and the nectar said to produce poisonous honey. On rocky hillsides and along streams. Occasionally cultivated. N. S. to Ont., Ohio, Ga., and Ala.

22. **Kálmia** L. *Kalmia*.

Shrubs or small trees with simple, alternate, entire, pinnately veined, coriaceous evergreen leaves, and with naked winter buds.

Flowers bisporangiate, pentamerous, sympetalous; stamens 10, the anthers at first in 10 pouches; fruit a capsule with small seeds.

1. **Kalmia latifolia** L. Mountain Kalmia. A shrub or small tree with evergreen leaves. All parts of the plant poisonous to cattle, sheep, and other animals. The honey from the flowers is said to be poisonous; also the flesh of game that has fed upon the leaves or fruit. In woods and on rocky hillsides. Occasionally planted. N. B. to Ont., Ohio, Ind., Fla., and La.

23. **Oxydéndrum** DC. Sorrel-tree.

Trees with simple alternate, pinnately veined, serrate, sour leaves, not glandular, but with prominent scattered bristle-like hairs on the midrib beneath; and with cylindrical pith and a central ring-shaped bundle-scar.

Flowers bisporangiate, pentamerous, white, numerous in terminal paniced racemes; fruit a capsule.

1. **Oxydendrum arboreum** (L.) DC. Sorrel-tree. A small tree with smooth bark and brilliantly red-colored leaves in autumn. Wood hard and close-grained, reddish-brown; used for handles of tools, bearings of machinery, etc. On hillsides. Ind., Ohio and Penn. to Va., Fla., and Ala.

Order, **EBENALES**.

Sapotaceae. Sapodilla Family.

24. **Bumèlia** Sw. *Bumelia*.

Shrubs or small trees with alternate, simple, pinnately veined, entire leaves; with milky sap; and usually with both terminal and axillary thorns.

Flowers small in axillary fascicles, pentamerous; fruit a fleshy berry with a single seed.

1. Leaves glabrous or nearly so; oblanceolate to oblong-ovate, 2-5 in. long. *B. lycioides*.

1. Leaves tomentose or silky; oblong-obovate to cuneate-obovate, usually obtuse, 1-3 in. long. *B. lanuginosa*.

1. **Bumelia lycioides** (L.) Gaertn. f. Buckthorn Bumelia. A shrub or small tree usually with thorns and thornlike spurs and with gray bark. Leaves tardily deciduous. Wood very hard, yellowish-brown. In moist soil. Va. to Ill., Mo., Fla., and Texas.

2. **Bumelia lanuginosa** (Mx.) Pers. Woolly Bumelia. A shrub or rather large tree with persistent leaves. Wood rather soft, weak, yellowish-brown. Ill. to Kan., Tex., Ga., and Fla.

Ebenaceae. Ebony Family.

25. **Diospyros** L. Persimmon.

Trees, ours with alternate, pinnately veined, entire, deciduous leaves, having the petiole jointed to the twig; and with a central bundle scar.

Flowers monosporangiate; fruit a large berry with 4-12 flat oblong seeds.

1. **Diospyros virginiana** L. Persimmon. A handsome tree with hard, dark, furrowed bark. Pith often with cavities. Berry large, pulpy, yellow, exceedingly astringent when green, but sweet and edible after frost. Bark astringent and tonic. Wood very hard, heavy, strong, and tough, close-grained and dark-colored; used in turnery, for shuttles, plane stocks, and shoe lasts. R. I. to Ohio, Iowa and Kan., Fla., and Texas.

Symplocaceae. Sweetleaf Family.

26. **Symplocos** Jacq. Sweetleaf.

Shrubs or trees with simple, alternate, serrate or repand leaves; with diaphragmed pith showing lenticular cavities; and with axillary buds not superposed.

Flowers bisporangiate, pentamerous, but the stamens numerous; fruit a small, mostly nearly dry drupe.

1. **Symplocos tinctoria** (L.) L'Her. Sweetleaf. A shrub or small tree, the pith diaphragmed. Flowers bright yellow, fragrant; drupe nutlike. Wood soft, weak, pale red or white. Del. to Fla., La., and Ark.

Styracaceae. Storax Family.

27. **Halesia** Ell. Silverbell.

Shrubs or small trees with simple, alternate, serrate leaves, with diaphragmed pith showing cavities; and with superposed axillary buds.

More or less stellate pubescent; flowers large, white, drooping, in lateral fascicles or short racemes; fruit dry, 2-4-winged.

1. **Halesia carolina** L. Silverbell. A small tree with diaphragmed pith. Wood soft, light brown. In woods and along streams. Va. to Ill., Fla., and Ala.

Subclass, TUBIFLORAE.

Order, GENTIANALES.

Oleaceae. Olive Family.

28. **Chionanthus** L. Fringetree.

Shrubs or small trees with opposite, simple, entire deciduous leaves, pinnately veined to the tip; and with pubescent twigs and buds.

Flowers bisporangiate, in large loose panicles; perianth tetramerous; fruit a drupe.

1. **Chionanthus virginica** L. Fringetree. A shrub or small tree with handsome, white, fragrant flowers in drooping panicles. Wood heavy, hard, and light brown. In moist soil. N. J. and Ohio to Fla., Mo., and Texas.

29. **Forestiera** Poir. Adelia.

Shrubs or small trees with simple, opposite, pinnately veined, usually serrate leaves; with brown twigs; and usually with thorns and superposed buds.

Flowers diecious or imperfectly monosporangiate, in fascicles, or paniculate, from scaly buds; fruit a drupe.

1. **Forestiera acuminata** (Mx.) Poir. Adelia. A shrub or small tree usually with somewhat thorny branches.

Wood heavy, soft, yellowish-brown, not strong. On river banks. Ind. to Ga., Mo., Ark., and Texas.

30. **Fráxinus** (Tourn.) L. Ash.

Trees with opposite odd-pinnate leaves without stipules or stipels and with closely crowded bundle scars in a curved line.

Flowers sympetalous or apetalous, bisporangiate or monosporangiate; stamens usually 2; fruit a samara.

1. Leaflets sessile. 2.
1. Leaflets more or less stalked. 3.
2. Leaflets 7-11, long, gradually tapering to a point, oblong lanceolate. *F. nigra*.
2. Leaflets short pointed, ovate to obovate. *F. excelsior*.
3. Twigs not quadrangular. 4.
3. Twigs quadrangular; stems sometimes sharply four-angled; leaflets 7-11, green on both sides, upper ones usually sessile, lower ones short stalked. *F. quadrangulata*.
4. Twigs pubescent, often velvety. 5.
4. Twigs smooth or nearly so. 7.
5. Leaflets ovate to ovate lanceolate; base usually truncate or rounded, unsymmetrical; upper surface dark yellow-green, soft pubescent beneath; calyx large. *F. profunda*.
5. Leaflets ovate, ovate-lanceolate, or lanceolate, usually acute at the base; calyx minute. 6.
6. Leaflets pale beneath; ovate to ovate-lanceolate, 7-11; wing of samara terminal or nearly so. *F. biltmoreana*.
6. Leaflets green or greenish beneath, ovate-lanceolate to lanceolate, 5-9; samara with a decurrent wing. *F. pennsylvanica*.
7. Leaflets pale beneath, ovate to ovate-lanceolate, entire or indefinitely serrate, abruptly acute or acuminate, glabrous or somewhat pubescent; wing of samara terminal. *F. americana*.
7. Leaflets green on both sides, glabrous or somewhat pubescent, usually serrate, lanceolate to ovate-lanceolate, acuminate; wing of samara decurrent on the sides of the slender body. *F. lanceolata*.

1. **Fraxinus quadrangulâta** Mx. Blue Ash. A large tree with 4-sided or 4-winged twigs. Leaflets 7-11, ovate, oblong, or lanceolate, acuminate, green on both sides, sharply serrate or serrulate; samara linear-oblong or cuneate, winged all around, parallel-nerved, the body extending more than half-way to the apex. The inner bark furnishes a blue dye. Wood heavy, hard and valuable; used for flooring, carriage-making, etc. Ont., Minn., and Mich., to Ala., Iowa and Ark.

2. **Fraxinus nigra** Marsh. Black Ash. A large tree. Leaflets 7-11 glabrous, green on both sides, sessile, oblong-lanceolate, long acuminate, sharply serrate or serrulate, samara oblong or linear-oblong, parallel-nerved, the body flat, winged all around and extending to or beyond the middle. Wood heavy, soft, dark brown, used for barrel hoops, baskets, cabinet-work and interior finish. In swamps and wet soil. Newf. to Man., Va., and Ark.

3. **Fraxinus excelsior** L. European Ash. A fine hardy tree with bright green leaves. Samara flat, linear-oblong. Weeping varieties are in cultivation. Native of Europe.

4. **Fraxinus profunda** Bush. Pumpkin Ash. A large tree with thick, gray, fissured bark and velvety pubescent twigs. Leaflets 7-9, ovate-lanceolate to oblong-lanceolate, stalked, acuminate, bright green above, paler and pubescent beneath, large. Samara with a flattish body, wing decurrent to below the middle. In swamps. Va. to Ill., Mo., Ark., and Fla.

5. **Fraxinus pennsylvânica** Marsh. Red Ash. A large tree with velvety-pubescent twigs. Leaflets 5-9, ovate, ovate-lanceolate, or oblong, acuminate or acute, usually denticulate; body of the samara linear margined above by the linear or spatulate decurrent wing. Wood hard, strong, brown. In moist soil. N. B. to Minn., Fla., and Kan.

6. **Fraxinus lanceolâta** Borkh. Green Ash. A large tree with glabrous twigs. Leaflets 5-9, entire or denticulate, ovate or oblong-lanceolate, acuminate or acute, green on both sides; samara similar to that of the two preceding species, wing usually spatulate and decurrent on the sides of the body below the middle. Wood rather inferior in value to that of the white

ash. In moist soil, on flood-plains, and on bluffs. Me. to Sask., south to Fla., Kan., and Texas.

7. **Fraxinus biltmoreana** Bead. Biltmore Ash. A tree with the young twigs pubescent. Leaflets 7-9, ovate to lanceolate, acuminate, entire or obscurely denticulate, more or less pubescent beneath; body of the samara narrowly elliptic, terete; wing linear, or somewhat broadened above, 2-3 times the length of the body. Woodlands and river banks. Penn. and Ohio to Ga.

8. **Fraxinus americana** L. White Ash. A large tree of rapid growth, with glabrous twigs. Leaflets 5-9, ovate-lanceolate, oblong, or rarely slightly obovate, entire or denticulate, pale and often pubescent beneath, acuminate or acute; body of the samara terete, not margined, winged only from near the summit, $\frac{1}{4}$ - $\frac{1}{2}$ the length of the wing. Autumn leaves brown, purple, and salmon. Wood heavy, hard, strong, brown, tough and elastic, of very great value; widely used in the manufacture of agricultural implements, boat oars, and carriage shafts; in cabinet-work, for harness work, hoops, baskets, and clothespins. In rich soil. N. S. to Minn., Fla., Kan., and Texas.

Order, SCROPHULARIALES.

Bignoniaceae. Bignonia Family.

31. **Paulownia** Sieb. & Zucc. Paulownia.

Trees with opposite petioled, palmately veined, simple leaves; with superposed axillary buds; and with large white pith, sometimes with cavities.

Flowers in large panicles, bisporangiate, zygomorphic, tetracyclic; stamens 4; fruit a capsule with numerous winged seeds.

1. **Paulownia tomentosa** (Thumb.) Steud. Paulownia. A large rapid-growing tree with violet flowers in terminal panicles. Native of Japan; escaped from cultivation. N. Y. and N. J. to Ohio and Ga.

32. **Catalpa** Scop. Catalpa.

Trees with opposite or whorled, simple leaves with entire margins and with prominent green glands in the axils of the veins on the lower side.

Flowers large, white or mottled, in terminal panicles or corymbs, bisporangiate, zygomorphic; stamens usually 2 with 3 prominent vestiges; capsule long and bean-like with numerous winged seeds.

1. Young twigs glabrous or nearly so, leaf-blades downy below; flowers large, white, with 2 yellow stripes inside and spotted purplish brown. 2.
1. Young twigs and petioles with long hairs; leaf blades glabrous below or nearly so, commonly 3-lobed or angled, strong-scented, usually with 4 red oval glands at the base of the blade on the upper side; flowers small, yellow with orange stripes inside and violet spots; capsule very slender. *C. ovata*.
2. Bark thin, flaky; young petioles glabrous or nearly so; wings of seed usually narrowed at the ends, panicle many-flowered. *C. bignonioides*.
2. Bark thick and rough; young petioles usually pubescent; wings of seed usually broad, the threads parallel; panicle few-flowered. *C. speciosa*.

1. **Catalpa bignonioides** Walt. Common Catalpa. A tree with thin flaky bark and spreading branches. Wood brown, soft, weak, durable in contact with the soil, much less valuable than that of *C. speciosa*. The flowers are said to produce irritation of the skin. Gulf States. Escaped in the northern states as far as Ohio and N. Y.

2. **Catalpa speciosa** Ward. Hardy Catalpa. A large rapid-growing tree with thick rough bark. Wood light, soft, not strong, brittle, of very coarse texture and brown in color, very durable in the ground; used for railroad ties, posts, furniture and interior finish; also suitable for paper pulp. Ill. to Tenn., Mo., Ark., and Ohio.

3. *Catalpa ovata* Don. Japan Catalpa. A small tree, commonly with 3-lobed or angled leaves. Flowers small. From Japan. Often cultivated.

Subclass, CALYCIFLORAE.

Order, ROSALES.

Rosaceae. Rose Family.*Amygdalatae*. Peach Subfamily.33. **Prunus** (Tourn.) L. Apricot, Plum, Cherry.

Shrubs or trees with alternate, simple, serrate, pinnately-veined leaves, with disk-like or tooth-like glands on the petiole; with stipules or stipular scars, cylindrical pith, twigs some shade of brown, and with the fruit a drupe.

Terminal bud present or self-pruned; perianth pentamerous; carpel 1, hypanthium deciduous; drupe mostly edible.

1. Terminal bud usually present; leaves conduplicate in vernalion; stone globose, little or not at all flattened; inflorescence racemose, corymbose, or umbellate. 2.
1. Terminal bud self-pruned; leaves convolute in vernalion; stone of the drupe compressed; inflorescence umbellate or with only 1 or 2 flowers. 7.
2. Petioles usually not over $\frac{1}{2}$ in. long; leaves ovate, abruptly acute at the apex; flowers corymbose, terminating twigs of the season. *P. mahaleb*.
2. Petioles usually an inch or more long, or if not, the leaves not ovate; flowers in umbellate or somewhat corymbose clusters, or in racemes. 3.
3. Flowers in umbellate or corymbose clusters. 4.
3. Flowers in racemes. 6.
4. Leaves glabrous or nearly so. 5.
4. Leaves pubescent beneath, at least on the veins, with prominent hairs; inflorescence umbellate; drupe sweet. *P. avium*.
5. Leaves ovate-lanceolate to lanceolate; inflorescence more or less corymbose; drupe with thin sour flesh. *P. pennsylvanica*.
5. Leaves ovate to ovate-lanceolate; inflorescence umbellate, drupe with thick sour flesh. *P. cerasus*.
6. Leaves oval-lanceolate to ovate, acuminate or acute; glands on the petiole usually elongated and tooth-like; bark black; drupe dark-purple or black, sweet. *P. virginiana*.

6. Leaves obovate to oval, abruptly acute or acuminate; glands on the petiole usually rounded or disk-like; bark gray; drupe red or purple, astringent. *P. nana*.
7. Leaves abruptly acuminate, petiole much less than $\frac{1}{2}$ as long as the blade. 8.
7. Leaves abruptly long-acute or acuminate, ovate to round-ovate; petiole $\frac{1}{2}$ as long as the blade; flowers solitary or in twos; fruit velvety. *P. armeniaca*.
7. Leaves acute or obtusish, or gradually acuminate. 10.
8. Leaves mostly broad and thick, somewhat pubescent or roughish beneath; calyx lobes pubescent or glabrous within. 9.
8. Leaves mostly narrow and peach-like, firm and more or less shining, glabrous; calyx lobes pubescent on both sides. *P. hortulana*.
9. Calyx-lobes entire, pubescent within; fruit globose; flowers white. *P. americana*.
9. Calyx lobes glandular-serrate, glabrous within; fruit subglobose or oval; flowers white, turning pink. *P. nigra*.
10. Leaves glabrous when mature, acute or acuminate. 11.
10. Leaves pubescent beneath, not pointed or only slightly so, ovate or obovate. *P. domestica*.
11. Leaves lanceolate; drupe red with little or no bloom. *P. angustifolia*.
11. Leaves ovate, drupe dark purple, with a bloom. *P. alleghaniensis*.

Cherries.

1. *Prunus virginiana* L. Black Cherry. A large tree with rough, black, flaky bark; drupe globose, dark-purple or black, sweet but slightly astringent. Leaves oval, oval-lanceolate, or ovate, acuminate or acute, serrate with appressed teeth. Leaves very poisonous to cattle, especially when half-wilted. Kernels very poisonous. Wood rather heavy, hard, strong, of fine texture, of a brown or reddish color; much used in cabinet-work and interior finish, especially in cars and boats, also used in turnery. Self-prunes twigs by means of cleavage planes in basal joints. Ont. to Fla., N. Dak., Kan., Tex., and Ohio.

2. **Prunus nàna** Du Roi. Choke Cherry. A shrub or small tree with gray bark. Leaves obovate or broadly oval, abruptly acute or acuminate at the apex, rounded at the base, serrulate with slender teeth, glabrous or nearly so. Drupe red to nearly black, sometimes yellow, very astringent, not edible. Leaves poisonous; kernels probably poisonous. Self-prunes leafy fruiting branches. Along river banks and in rocky places. Newf. to Man., Br. Col., Ga., Neb., Texas, Colo., and Ohio.

3. **Prunus mahàleb** L. Mahaleb Cherry. A small tree with pale smooth bark. Leaves ovate, abruptly acute at the apex, rounded or slightly cordate at the base, denticulate, glabrous, fragrant. Drupes with thin flesh and slightly flattened stone. From Europe. Conn. to Ont., N. Y. to Ohio and Kan.

4. **Prunus pennsylvànica** L. f. Red Cherry. A small tree with sour globose, red drupes. Leaves oval or lanceolate, acute or acuminate, mainly rounded at the base, glabrous, serrulate. Leaves poisonous; kernels probably poisonous. In rocky woods. Newf. to Ga., west to Rocky Mts.

5. **Prunus àvium** L. Sweet Cherry. A medium-sized tree with globose, black or dark red, sweet, edible drupes. Leaves ovate, oval, or slightly obovate, abruptly short-acuminate, irregularly serrate. Native of Europe. Ont. to Mass., Ohio and Va.

6. **Prunus cérasus** L. Sour Cherry. A small tree with globose, red or reddish-black, sour, edible drupes. Leaves ovate or ovate-lanceolate, abruptly acute or acuminate, rounded at the base, very resinous when young. Self-prunes the fruiting branchlets. Native of Europe. N. H. and Mass. to N. Y. and Ohio.

Plums and Apricot.

7. **Prunus armeniaca** L. Apricot. A small round-topped tree with reddish bark. Drupe nearly smooth, short stalked, yellow, edible. Cultivated.

8. **Prunus americàna** Marsh. Wild Plum. A shrub or small tree with stunted thorn-like branches and thick black bark. Leaves ovate, or obovate sharply and often doubly serrate, rounded at the base, slender-petioled. Drupe with a tough skin, globose, red or yellowish, edible. Often used as a stock

on which to graft domestic plums. Wood hard, reddish in color. N. Y. to Mont., Fla., Colo., and Ohio.

9. **Prunus nigra** Ait. Canada Plum. A tree with thin bark. Leaves oval, ovate, or obovate, long-acuminate, crenulate-serrate; drupe oval, orange-red, thick-skinned, with little or no bloom. Petals pink in age. Newf. to Man., Mass. and Wis.

10. **Prunus hortulana** Bail. Wild-goose Plum. A small tree with spreading branches and thin bark. Leaves ovate-lanceolate to ovate, long-acuminate, closely glandular-serrate. Drupe bright red and thin-skinned, edible. Ill. to Kan., Tenn., and Texas.

11. **Prunus angustifolia** Marsh. Chickasaw Plum. A small tree with thorn-like stunted branches. Leaves acute, serrulate, often rounded at the base. Drupe globose, red, and edible. In dry soil. N. J. to Fla., west to Rocky Mts.

12. *Prunus domestica* L. Common Garden Plum. A small tree with about 100 cultivated varieties. Drupe of various colors, covered with a thick glaucous bloom.

13. **Prunus alleghaniensis** Port. Alleghany Plum. A low shrub or small tree, seldom thorny. Leaves acute or acuminate, finely serrate, rounded at the base. Drupe pleasantly acid, globose-ovoid, with a conspicuous bloom. Penn.

34. **Amýgdalus** L. Peach.

Trees or shrubs with alternate, simple, serrate, pinnately-veined leaves with 2-4 disk-like glands at the edge of the base of the blade, with terminal bud, stipular scars or stipules, reddish or greenish twigs, and velvety drupe.

Perianth pentamerous, carpel 1, hypanthium deciduous; drupe mostly edible with a deeply pitted stone.

1. **Amýgdalus pérsica** L. Peach. A small tree with beautiful pink or white flowers and a large edible drupe. Leaves with prominent nectar glands on the petiole or at the base of the blade. Leaves and kernels bitter, poisonous. Native of Asia; abundantly escaped. N. Y. to Fla. and Kan.

Malatae. Apple Subfamily.35. **Sórbus** (Tourn.) L. Mountain-ash.

Trees or shrubs with alternate, odd-pinnate leaves, terminal buds, cylindrical pith, and 3-5 bundlescars in the narrow leaf scar.

Flowers bisporangiate; fruit a small red berry-like pome, in compound cymes.

1. Leaflets glabrous above. 2.
1. Leaflets pubescent on both sides; calyx and pedicels usually woolly. *S. aucuparia*.
2. Leaflets long-acuminate; fruit less than $\frac{1}{4}$ in. in diameter. *S. americana*.
2. Leaflets obtuse or short-pointed; fruit more than $\frac{1}{4}$ in. in diameter. *S. scopulina*.

1. **Sorbus americana** Marsh. American Mountain-ash. A small tree with smooth bark. Bark and unripe fruit very astringent. Wood soft, light brown. In moist ground. Much prized for ornamental planting. Newf. to Man., N. Car., and Mich.

2. **Sorbus scopulina** Greene. Western Mountain-ash. A small tree with smooth bark. In moist ground. Lab. to Alaska, N. Eng., Ohio, Mich., and in Rocky Mts. to Colo. and Utah.

3. **Sorbus aucuparia** L. European Mountain-ash. A small tree, native of Europe. Frequently cultivated. Fruit poisonous to man, but eaten by some birds. N. S. to N. H.

36. **Màlus** Mill. Apple, Crab-apple.

Trees or shrubs with alternate, simple, pinnately-veined, dentate, serrate or more or less lobed leaves, with stipules or stipular scars; with terminal buds, cylindrical pith, and fruit a pome without grit cells.

Flowers bisporangiate with a fleshy hypanthium united with the ovulary, pentamerous, stamens numerous.

1. Leaves glabrous, at least when mature. 2.
1. Leaves persistently pubescent or tomentose beneath. 3.
2. Leaves oblong, oval, or lanceolate, narrowed at the base. *M. angustifolia*.

2. Leaves ovate, rounded or cordate at the base, often somewhat lobed. *M. coronaria*.
2. Leaves ovate, acute or acuminate at the apex and acute at the base, on slender petioles; finely and nearly evenly serrate. *M. Baccata*.
3. Leaves mostly narrowed at the base; pome 1-2 in. in diameter. *M. ioensis*.
3. Leaves rounded or cordate at the base; pome usually large, 2-4 in. in diameter. *M. sylvestris*.

1. **Malus angustifolia** (Ait.) Mx. Narrow-leaf Crab-apple. A small tree usually with thorn-like stunted branches or spurs. Leaves oblong, oblong-lanceolate, or oval, thick, shining above, sometimes pubescent beneath when young, dentate or often entire. Wood hard, reddish-brown. On low ground. N. J. to Ill., Kan., Fla., and La.

2. *Malus baccata* (L.) Borkh. Siberian Crab-apple. A small spreading tree with compact crown. Pedicles very slender; fruit small, not becoming mellow. Cultivated.

3. **Malus coronaria** (L.) Mill. Fragrant Crab-apple. A small tree with hard and sour fruit suitable for preserving. Leaves ovate, to triangular-ovate, sparingly pubescent beneath when young, sharply serrate and often somewhat lobed. Wood soft and reddish-brown. On low ground. Ont. to Mich., S. Car., Iowa, and Kans.

4. **Malus ioensis** (Wood) Britt. Iowa Crab-apple. A small tree much resembling *M. coronaria*. Leaves ovate, oval, or oblong, dentate, crenate or with a few rounded lobes, white pubescent beneath, at length glabrous above. Minn., Wis., and Ill., to Neb., Ky., La., and Okla.

5. **Malus sylvestris** Mill. *M. malus* (L.) Britt. Common Apple. A medium-sized tree with spreading branches. Leaves ovate or oval, glabrous or nearly so above, pubescent and often woolly beneath. Fruit large, various. Introduced from Europe and escaped in many places. The seeds are poisonous. Me. to N. Y., N. J., Ohio, and Ga.

37. **Pyrus** (Tourn.) L. Pear.

Trees or shrubs with alternate, simple, pinnately-veined, serrate leaves with long petioles; with stipules or stipular

scars; with terminal buds, cylindrical pith, and fruit a pome with grit cells.

Flowers bisporangiate with a fleshy hypanthium united with the ovulary; pentamerous; stamens numerous.

1. **Pyrus commùnis** L. Pear. A pyramidal usually slender tree, often with thorn-like stunted branches. Bark smooth. Wood hard, fine-grained, reddish-brown. Cultivated for its large fleshy fruit. Native of Europe and Asia. Me. to N. J. and Ohio.

38. **Cydònia** Tourn. Quince.

Shrubs or low small trees, our cultivated species with alternate, simple, pinnately veined, entire, deciduous leaves with stipules or stipular scars; cylindrical pith, and with fruit a pome containing many seeds in each cavity.

Flowers bisporangiate, perianth pentamerous, pome fleshy.

1. *Cydonia oblònga* Mill. Quince. A low tree with crooked stem and rambling branches. Cultivated for the large sour fleshy fruit.

39. **Amelánchier** Medic. Juneberry.

Shrubs or small trees with alternate, simple, serrate, pinnately-veined leaves; with 3 bundle scars, terminal bud, a narrow leaf scar, and fruit a berry-like pome.

Flower bisporangiate, perianth pentamerous, pome small with twice the number of cavities as styles.

1. Leaves acute or acuminate at the apex; top of the ovulary glabrous or nearly so. 2.
1. Leaves rounded, obtuse or subacute at the apex; top of the ovulary woolly; petals $\frac{1}{2}$ - $\frac{3}{4}$ in. long. *A. sanguinea*.
2. Leaves glabrous when mature, but pubescent or woolly when young, ovate to ovate-lanceolate; base cordate or rounded. *A. canadensis*.
2. Leaves densely white-woolly beneath, at least when young, oblong to obovate, rarely sub-cordate at the base. *A. intermedia*.

1. **Amelanchier canadésis** (L.) Med. Common Juneberry. A medium-sized tree with a small, red or purple, sweet

and edible, berry-like pome. Wood very hard, brown. In dry soil. Nova Scotia to Ont., Fla., La., and Ark.

2. **Amelanchier intermèdia** Spach. Swamp Juneberry. A shrub or small tree growing in swamps and moist soil. Variable. N. Eng. to Ont., Fla., and La.

3. **Amelanchier sanguinea** (Pursh) DC. Roundleaf Juneberry. A tall shrub or small tree growing in woods and thickets. N. B. to Minn., N. C., and Mich.

40. **Crataegus** L. Hawthorn.

Small trees or shrubs with simple, serrate or lobed leaves, with stipules or stipular scars, and usually with typical axillary thorns, but without terminal thorns.

Flowers bisporangiate, perianth pentamerous, stamens 5-25; pome drupe-like with bony ripe carpels.

The species of *Crataegus* are at present in a very unsatisfactory condition. Probably many of those included below are merely hybrids or forms of freely interbreeding elementary varieties. Many of the specific English names are also unsatisfactory. W. W. Eggleston's treatment of the species of the northeastern United States is mainly followed below.

Required for identification, the leaves and fruit.

1. Leaves not deltoid-cordate. 2.
1. Leaves conspicuously deltoid-cordate, glabrous. (Cordatae). 55.
2. Leaves glabrous, glabrous above and pubescent beneath, or pubescent on both sides. 3.
2. Leaves pubescent above, glabrous beneath; thorns $\frac{1}{4}$ -1 in. long; fruit black. (Douglasianae). 54.
3. Petioles $\frac{1}{2}$ in. long or longer. 4.
3. Petioles less than $\frac{1}{2}$ in. long. (Parvifoliae). 53.
4. Leaves not deeply cut. 5.
4. Leaves deeply cut, lobes numerous; thorns less than 1 in. long. (Oxyacanthae). 52.
5. Leaves broadest at the middle or apex, cuneate. 6.
5. Leaves broadest at the base. 12.
6. Leaves broadest toward the apex. 7.
6. Leaves broadest at the middle. 8.

7. Leaves shining, not impressed-veined above. (*Crus-galli*). 14.
 7. Leaves dull, impressed-veined above. (*Punctatae*). 18.
 8. Petioles usually glandless, or if so then the nutlets pitted on the ventral faces. 9.
 8. Petioles always with small stalked glands along their entire length; nutlets without ventral pits. (*Intricatae*). 30.
 9. Calyx - lobes glandular - laciniate, glandular - serrate, or glandular-margined. 10.
 9. Calyx-lobes not glandular - margined; leaves not impressed - veined, often trilobed towards the apex. (*Virides*). 29.
 10. Leaves impressed-veined. 11.
 10. Leaves not impressed-veined, elliptic ovate to orbicular; calyx-lobes glandular-margined; leaves not trilobate (*Rotundifoliae*). 24.
 11. Leaves rhombic-elliptic; calyx-lobes usually deeply cut; nutlets deeply pitted on the ventral faces. (*Macracanthae*). 21.
 11. Leaves elliptic to ovate; calyx-lobes less deeply cut; nutlets with shallow pits on the ventral faces. (*Brainerdianae*). 23.
 12. Leaves $\frac{1}{2}$ -2 $\frac{1}{2}$ in. long and wide, membranous; calyx-lobes usually entire. 13.
 12. Leaves 1-4 in. long and wide; calyx-lobes usually serrate. (*Coccineae*). 44.
 13. Leaves yellow-green often slightly pubescent; fruit soft at maturity. (*Tenuifoliae*). 34.
 13. Leaves blue-green, usually glabrous; fruit hard at maturity. (*Pruinosae*). 38.
- *Crus-galli*. —
14. Leaves not lobed. 15.
 14. Leaves somewhat lobed. 16.
 15. Leaves $\frac{3}{4}$ -4 in. long. *C. crus-galli*.
 15. Leaves $\frac{3}{4}$ -2 $\frac{1}{2}$ in. long. *C. berberifolia*.
 16. Styles and nutlets usually 2. *C. schizophylla*.
 16. Styles and nutlets usually 3-5. 17.

17. Lobes of the leaves irregular, obtuse; fruit globose.
C. denaria.

17. Lobes of the leaves regular, acute; calyx-lobes serrate.
C. fecunda.

— *Punctatae.* —

18. Fruit ellipsoidal; nutlets usually 3 or 4. 19.

18. Fruit globose. 20.

19. Leaves bright yellow-green, slightly impressed-veined above. *C. cuneiformis.*

19. Leaves dull gray-green, strongly impressed-veined above, obovate, narrow. *C. punctata.*

20. Nutlets 2 or 3. *C. margaretta.*

20. Nutlets 4 or 5. *C. suborbiculata.*

— *Macracanthae.* —

21. Leaves dark green, glabrous and shining above, coriaceous. 22.

21. Leaves gray-green, pubescent and dull above, subcoriaceous, rhombic-ovate, lobed. *C. calpodendron.*

22. Fruit $\frac{3}{4}$ in. thick or less; leaves large. *C. succulenta.*

22. Fruit $\frac{1}{2}$ in. thick or less; leaves small. *C. neofluvialis.*

— *Brainerdianae.* —

23. Fruit and corymbs pubescent; calix-lobes sharply glandular-serrate; leaves serrate; styles and nutlets 2 or 3. *C. pertomentosa.*

23. Fruit and corymbs glabrous; calix-lobes remotely glandular-serrate. *C. brainerdi.*

— *Rotundifoliae.* —

24. Leaves longer than wide. 25.

24. Leaves about as wide as long. 26.

25. Leaf lobes acuminate. *C. laurentiana.*

25. Leaf lobes acute. *C. lucorum.*

26. Leaf-lobes acuminate. *C. irrasa.*

26. Leaf-lobes acute or obtuse. 27.

27. Calyx-tube prominent; fruit subglobose. *C. macaulleyae.*

27. Calyx-tube obscure. 28.

28. Leaves acutely lobed toward the apex; calyx-lobes glandular-laciniate. *C. bicknellii.*

28. Leaves not acutely lobed; calyx-lobes glandular m.

gined only; fruit globose, red, round in cross section.
C. chrysocarpa.

— *Virides*. —

29. Leaves ovate; lobes shallow; fruit yellow-red. *C. ovata*.
 29. Leaves oblong-ovate, lobes deep; fruit bright red, glaucous. *C. viridis*.

— *Intricatae*. —

30. Foliage and fruit pubescent; corymbs villous. 31.
 30. Foliage, fruit, and corymbs glabrous. 32.
 31. Fruit globose, greenish to reddish-brown. *C. intricata*.
 31. Fruit ellipsoid or pyriform, yellow. *C. stonei*.
 32. Leaves cordate, lobed. *C. populifolia*.
 32. Leaves cuneate, lobed. 33.
 33. Leaves elliptic-ovate; fruit pyriform-ellipsoid. *C. straminea*.
 33. Leaves ovate to oval; fruit globose or subglobose, reddish-green to reddish-brown. *C. boyntoni*.

— *Tenuifoliae*. —

34. Fruit ellipsoid, ovoid, or pyriform; calyx-lobes entire. 35.
 34. Fruit compressed-globose or subglobose. 36.
 35. Leaves much lobed; fruit small, $\frac{1}{4}$ - $\frac{1}{3}$ in. thick, with rather firm flesh. *C. roanensis*.
 35. Leaves not conspicuously lobed; fruit large; $\frac{1}{2}$ - $\frac{3}{4}$ in. thick, with soft flesh. *C. macrosperma*.
 36. Lobes of the leaves reflexed. *C. grayana*.
 36. Leaf-lobes spreading or ascending. 37.
 37. Terminal leaves cuneate. *C. alnorum*.
 37. Terminal leaves cordate. *C. populnea*.

— *Pruinosae*. —

38. Leaves elliptic-ovate. *C. jesupi*.
 38. Leaves ovate. 39.
 39. Leaves usually cordate. 40.
 39. Leaves usually cuneate. 41.
 40. Fruit conspicuously angled, strongly pruinose. *C. rugosa*.
 40. Fruit not conspicuously angled, only slightly pruinose. *C. filipes*.

- 41. Lobes of the leaves deep, acuminate. *C. leiophylla*.
- 41. Lobes of the leaves shallow, acute. 42.
- 42. Fruit without conspicuous angles. *C. beata*.
- 42. Fruit conspicuously angled. 43.
- 43. Leaves deltoid. *C. gattingeri*.
- 43. Leaves ovate. *C. pruinosa*.

— *Coccincae*. —

- 44. Mature leaves usually glabrous above; young foliage bronze-green. 45.
- 44. Mature leaves tomentose above; young foliage yellow-green. 50.
- 45. Leaves oblong-ovate. 46.
- 45. Leaves broadly ovate. 47.
- 46. Corymbs nearly glabrous. *C. villipes*.
- 46. Corymbs very pubescent. *C. anomala*.
- 47. Corymbs and fruit glabrous. *C. coccinioides*.
- 47. Corymbs and fruit pubescent or tomentose. 48.
- 48. Leaves on the vegetative shoots cuneate. 49.
- 48. Leaves on the vegetative shoots cordate. *C. albicans*.
- 49. Leaves concave, 1½-3 in. long, 1¼-2¾ in. wide. *C. pringlei*.
- 49. Leaves plane 1½-4 in. long, 1¼-3½ in. wide. *C. coccinea*.
- 50. Leaves on the vegetative shoots cuneate at the base. 51.
- 50. Leaves on the vegetative shoots cordate. *C. mollis*.
- 51. Lobes of the leaves broad, shallow, acuminate. *C. arnoldiana*.
- 51. Lobes narrow, deep, and acute; fruit ellipsoid-pyriform. *C. submollis*.

— *Oxyacanthae*. —

- 52. Leaves ovate, 3-15-lobed or cleft. *C. monogyna*.

— *Parvifoliae*. —

- 53. Leaves small, subcoriaceous, corymbs 1-3-flowered. *C. uniflora*.

— *Douglasianae*. —

- 54. Leaves subcoriaceous, petioles ¼-¾ in. long. *C. douglasii*.

— *Cordatae*. —

55. Leaves often conspicuously 3-5-lobed, petioles $\frac{1}{2}$ -2 in. long. *C. phaenopyrum*.

1. **Crataegus crús-gálli** L. Cockspur Hawthorn. A small tree with spreading branches and numerous slender thorns. Leaves coriaceous shining above, sharply serrate. Fruit ellipsoid-ovoid to subglobose, greenish to red, flesh hard, remaining on the branches until late in the winter. The best hawthorn for hedges. N. Y. to Ont., south to Conn., Ga., and Kan.

2. **Crataegus berberifolia** T. & G. Barberry-leaf Hawthorn. A small tree with spreading branches and a broad crown, with few thorns. Leaves oblong-cuneiform, spatulate, or obovate, rough-pubescent above, white-pubescent or tomentose beneath. Fruit subglobose to short-ellipsoid, yellow, orange, or red. Ky. to Mo. and the Gulf States.

3. **Crataegus schizophylla** Eggl. Martha's Vineyard Hawthorn. A small tree with irregular ascending branches and numerous thorns. Leaves oblong-ovate to ovate, coarsely serrate with short acute lobes toward the apex, glabrous, slightly impressed-veined. Fruit pyriform-ellipsoid, dark red; nutlets ribbed on the back. Mass.

4. **Crataegus denària** Beadle. Palmer's Hawthorn. A small tree with spreading branches and a round-topped crown. Leaves oval, ovate, or oblong-ovate, often slightly lobed towards the apex. Fruit globose or subglobose, reddish-green or light red. In low rich soil. Ky. to Mo. and Miss.

5. **Crataegus fecúnda** Sarg. Fruitful Hawthorn. A small tree with spreading branches and numerous thorns. Leaves oblong-obovate to oval. Fruit short-ellipsoid to subglobose, orange-red, slightly pubescent. Rich bottom lands. Ill. and Mo.

6. **Crataegus cuneifórmis** (Marsh.) Eggl. Marshall's Hawthorn. A small tree with widely spreading branches, dark brown scaly bark, and numerous, often branched thorns. Leaves oblanceolate-obovate. Fruit ellipsoid-pyriform, scarlet or dark red. N. Y. and Pa. to Va. and Ill.

7. **Crataegus punctàta** Jacq. Dotted Hawthorn. A

small flat-topped tree with horizontal or ascending branches and light gray thorns. Leaves obovate, serrate, doubly serrate, or lobed at the apex. Fruit short-ellipsoid, yellow or red, somewhat edible. Quebec to Pa., Minn., Iowa, and Ky.

8. **Crataegus margarétta** Ashe. Margaret's Hawthorn. A shrub or small tree with ascending branches forming a round crown. Leaves oblong-obovate to ovate, serrate or doubly serrate, usually somewhat lobed. Fruit dull rusty green, yellow, or red, compressed globose to short ellipsoid, angular. Ont. to Iowa, Mo., Tenn., and Va.

9. **Crataegus suborbiculàta** Sarg. Caughuawaga Hawthorn. A small tree with spreading branches and a broad crown. Leaves ovate-orbicular, serrate or doubly serrate. Fruit globose or compressed-globose, dull green to scarlet. In limestone areas. Montreal to Mich.

10. **Crataegus succulènta** Schrad. Longthorn Hawthorn. A small tree with ascending branches forming a broad irregular crown, and with numerous bright, brown thorns. Leaves rhombic-ovate to obovate, doubly serrate and usually somewhat lobed toward the apex. Fruit globose or short-ellipsoid, dark red. N. S. to Minn., N. C., Neb., and Colo.

11. **Crataegus neoffuviàlis** Ashe. New River Hawthorn. A small tree with ascending and spreading branches, and numerous thorns. Leaves elliptic-ovate to obovate, doubly serrate and somewhat lobed towards the apex, coriaceous, dark green and shining above. Fruit globose or short-ellipsoid, dark red. Vt. to Wis., N. C., and Iowa.

12. **Crataegus calpodéndron** (Ehrh.) Medic. Pear Hawthorn. A shrub or small tree with ascending and spreading branches forming a broad crown, with stout thorns and tomentose twigs. Leaves rhombic-ovate, acute or acuminate at the apex, doubly serrate. Fruit pyriform or ellipsoid, orange-red or red. N. Y. and N. J. to Minn. and Mo.

13. **Crataegus pertomentòsa** Ashe. Prairie Hawthorn. A small tree with nearly horizontal branches forming a flattened crown and with numerous curved thorns. Leaves oblong to obovate, finely doubly serrate or lobed. Fruit globular or nearly so, cherry-red, villous when young. Rocky soil. Iowa, Mo., and Kan.

14. **Crataegus brainerdi** Sarg. Brainerd's Hawthorn. A shrub or small tree with ascending branches. Leaves elliptic to ovate, finely doubly serrate or lobed. Fruit short-ellipsoid to globose, cherry-red to scarlet. N. Eng. to Iowa and Pa.

15. **Crataegus laurentiana** Sarg. Fernald's Hawthorn. A large, much-branched shrub or small tree with long thorns. Leaves oblong to oblong-ovate, sharply doubly serrate or lobed. Fruit ellipsoid, dark crimson. Newf., N. S., Quebec, Me., and shores of Lake Superior.

16. **Crataegus lucorum** Sarg. Grove Hawthorn. A shrub or small tree with ascending branches. Leaves oblong-ovate to broadly ovate, doubly serrate or lobed. Fruit pyriform-ellipsoid, crimson. Ill. and Wis.

17. **Crataegus irràsa** Sarg. Blanchard's Hawthorn. A shrub or small tree with numerous spines. Leaves ovate to elliptic, doubly serrate or lobed. Fruit subglobose to short-ellipsoid, red or scarlet, somewhat pubescent. Quebec to Vt. and N. Y.

18. **Crataegus macauleyae** Sarg. Macauley's Hawthorn. A small round-topped tree with somewhat pendulous branches. Leaves ovate to oval, doubly serrate or lobed. Fruit subglobose to short-ellipsoid, dark crimson. N. Y.

19. **Crataegus bicknélli** Eggl. Bicknell's Hawthorn. A round-topped shrubby tree with numerous stout thorns. Leaves ovate or oblong-ovate, sharply doubly serrate and lobed. Fruit globose, red. Mass.

20. **Crataegus chrysocarpa** Ashe. Roundleaf Hawthorn. A beautiful, round-topped shrub or small tree with numerous thorns. Leaves ovate-orbicular or obovate, doubly serrate or lobed, shining above. Fruit depressed-globose to short-ovoid, red. N. S. and N. B. to Saskatch., south to N. C., Neb., and N. M.

21. **Crataegus ovàta** Sarg. Ovate-leaf Hawthorn. A tree with yellow scaly bark. Leaves ovate-elliptic or obovate, coarsely serrate or doubly serrate, often somewhat lobed towards the apex, dark green and shining above. Fruit globose or compressed-globose, yellow to orange-red. River bottoms. Ky. and Mo.

22. **Crataegus vîridis** L. Green Hawthorn. A tree with ascending branches and a broad crown, often without thorns. Leaves oblong ovate, serrate or doubly serrate, often lobed toward the apex, dark green and shining above. Fruit globose or compressed-globose, bright red or orange, glaucous. Alluvial soil. Va. to Fla., Ind., Ill., Kan., and Texas.

23. **Crataegus intricâta** Lange. Biltmore Hawthorn. An irregularly branched shrub or small tree with few thorns. Leaves elliptic-ovate to broadly ovate, doubly serrate or lobed, rough-pubescent. Fruit short-ellipsoid to globose, greenish, yellow or becoming dark reddish-brown, somewhat pubescent. Open rocky woods. N. Eng. and N. Y., south to S. Car. and Mo.

24. **Crataegus stònei** Sarg. Stone's Hawthorn. A much-branched shrub or small tree with prominent thorns. Leaves oblong to oblong-ovate, doubly serrate or lobed. Fruit pyriform to short-ellipsoid, light yellow or yellow-green tinged with red. Rocky soil. Mass., Conn., and N. Y.

25. **Crataegus populifòlia** Walt. Poplar-leaf Hawthorn. A shrub or small tree with ascending and spreading branches forming a round crown. Leaves deltoid-ovate or oblong-ovate, serrate or doubly serrate with acute lobes. Fruit globose, light red, without angles. Va. to S. C.

26. **Crataegus stramínea** Beadle. Allegheny Hawthorn. An irregularly branched shrub or small tree with occasional thorns. Leaves elliptic-ovate, doubly serrate or lobed. Fruit pyriform to ellipsoid, angular, yellow-green. Rocky hills. Vt. to Mich., south to Del., Ala., and Mo.

27. **Crataegus boyntoni** Beadle. Boynton's Hawthorn. A round-topped, irregularly branched shrub or small tree with occasional thorns. Leaves oval to ovate, doubly serrate or slightly lobed. Fruit subglobose, orange-red or red-brown. Shaly soil. Mass. to Mich., south to S. C. and Tenn.

28. **Crataegus roanénsis** Ashe. Roan Mountain Hawthorn. A shrub or small tree with ascending branches and numerous curved thorns. Leaves ovate or oblong-ovate, serrate with acute straight lobes. Fruit ellipsoid, ovoid, or pyriform, crimson. Quebec to Wis., N. C., and Tenn.

29. **Crataegus macrospérma** Ashe. Variable Hawthorn. A shrub or small tree with ascending branches and numerous thorns. Leaves elliptic-ovate to broadly ovate, doubly serrate and somewhat lobed. Fruit ellipsoid or pyriform, scarlet to crimson, often glaucous. N. S. and Me. to Minn., N. C. and Tenn.

30. **Crataegus grayàna** Eggl. Gray's Hawthorn. A large shrub or small tree with ascending branches. Leaves ovate, doubly serrate with 4-6 pairs of acuminate lobes. Fruit subglobose to short ellipsoid, angular, dark cherry-red. N. Eng. to Ont. and N. Y.

31. **Crataegus alnòrum** Sarg. Edson's Hawthorn. A broad shrub or small tree with ascending branches. Leaves ovate, serrate or doubly serrate with acute lobes. Fruit subglobose, slightly angular, dark cherry-red. N. Eng. to Mich and Pa.

32. **Crataegus popùlnea** Ashe. Gruber's Hawthorn. A shrub or small tree with flattened round crown. Leaves broadly ovate to elliptic-ovate, slightly villous, serrate or doubly serrate, sometimes lobed. Fruit glabrous, short-ellipsoid, scarlet. Low ground. Ont. to Pa. and Del.

33. **Crataegus jésupi** Sarg. Jesup's Hawthorn. A large shrub or small tree with ascending branches. Leaves elliptic-ovate, serrate or doubly serrate with 4 to 5 pairs of acute lobes. Fruit short-ellipsoid to pyriform, slightly angled, dark red. Vt. to Wis. south to Pa.

34. **Crataegus rugòsa** Ashe. Rugose Hawthorn. A shrub or small tree with ascending branches. Leaves broadly ovate, serrate or doubly serrate with 4-6 pairs of broad acuminate lobes, glabrous. Fruit depressed-globose, bright red. Conn. to Pa., Ind., and N. C.

35. **Crataegus fílipes** Ashe. Beckwith's Hawthorn. A shrub or small tree with ascending branches and numerous thorns. Leaves ovate, serrate or twice serrate and lobed, glabrous. Fruit globose or compressed-globose, cherry-red. Western N. Eng. to Mich. south to Pa.

36. **Crataegus leipophýlla** Sarg. Maine's Hawthorn. A large shrub or small tree with erect branches and numerous

thorns. Leaves broadly ovate, doubly serrate, with 3-5 pairs of acuminate spreading lobes, dull. Fruit pyriform to globose, slightly angular, bright or dark scarlet. N. Y. to Pa.

37. *Crataegus beàta* Sarg. Dunbar's Hawthorn. A shrub or small tree with ascending or erect branches. Leaves ovate, doubly serrate with acute lobes, dull. Fruit short-ellipsoid, slightly angular, crimson. Ont. to Pa.

38. *Crataegus gattíngeri* Ashe. Gattinger's Hawthorn. A shrub or small tree with ascending branches forming an irregular crown, and with numerous thorns. Leaves narrowly ovate to deltoid, serrate or doubly serrate, lobed toward the apex, glabrous, dark green above. Fruit globose, angular, red. Pa. to Ind., south to W. Va. and Tenn.

39. *Crataegus pruinòsa* (Wendl.) Koch. Waxy-fruited Hawthorn. A shrub or small tree with ascending branches, irregular crown, and numerous slender thorns. Leaves elliptic-ovate to broadly ovate, doubly serrate with 3 or 4 pairs of broad acute lobes toward the apex, glabrous. Fruit depressed-globose or short-ellipsoid, strongly angled, pruinose, scarlet or purple. Rocky open woods. N. Eng. to Mich., N. C. and Mo.

40. *Crataegus vîllipes* Ashe. Thinleaf Hawthorn. A tree with strongly ascending branches. Leaves elliptic-ovate, serrate or doubly serrate with 4-6 pairs of acute or acuminate lobes, pubescent or scabrous. Fruit pyriform or ellipsoid, crimson. Maine to Quebec to Mich., south in the mountains to N. C.

41. *Crataegus anómala* Sarg. Oblong-leaf Hawthorn. A shrubby tree with numerous thorns. Leaves oblong to ovate, serrate or doubly serrate with acute lobes. Fruit pyriform-ellipsoid, crimson. Quebec to Mass. and N. Y.

42. *Crataegus cocciniòides* Ashe. Eggert's Hawthorn. A shrub or small tree with spreading branches. Leaves broadly ovate, doubly serrate, dark green above. Fruit sub-globose, obtusely angled. Quebec to R. I., west to Mo. and Kan.

43. *Crataegus prínglei* Sarg. Pringle's Hawthorn. A small tree with ascending branches. Leaves ovate to oval, doubly serrate, with shallow lobes. Fruit short-ellipsoid to

pyriform, pubescent, red. Western N. Eng. to Ill., south to Pa.

44. **Crataegus coccinea** L. Scarlet Hawthorn. A small tree with ascending and spreading branches and stout short thorns. Leaves broadly ovate, acute or acuminate at the apex, broadly cuneate or truncate at the base, doubly serrate or lobed, somewhat scabrous. Fruit pyriform to short ellipsoid, red, somewhat edible. Of considerable decorative value. Conn. to Ont., Ill., Del. and Pa.

45. **Crataegus albicans** Ashe. Tatnall's Hawthorn. A shrub or small tree with spreading branches. Leaves broadly ovate to oblong-ovate, doubly serrate or lobed. Fruit subglobose or somewhat pyriform, dark red. Western N. Eng. to Mich., south to Del. and Tenn.

46. **Crataegus arnoldiana** Sarg. Arnold's Hawthorn. A small tree with ascending branches, forming a broad crown, and numerous long thorns. Leaves broadly ovate to oval, serrate or doubly serrate with broad shallow lobes, tomentose or scabrous above. Fruit globose or subglobose, bright crimson, slightly pubescent; flesh thick, juicy, and edible. Mass. and Conn.

47. **Crataegus submollis** Sarg. Emerson's Hawthorn. A small tree with spreading branches, forming a broad symmetrical crown, and with numerous thorns. Leaves ovate, doubly serrate and acutely lobed, tomentose, becoming scabrate. Fruit short-ellipsoid to pyriform, orange-red, slightly tomentose, edible. Quebec to Mass. and N. Y.

48. **Crataegus mollis** (T. & G.) Scheele. Downy Hawthorn. A tree with spreading branches and densely pubescent twigs, forming a broad-topped crown. Leaves broadly ovate, doubly serrate with narrow acute lobes, densely tomentose. Fruit short-ellipsoid to subglobose, scarlet, edible. Ont. to S. Dak., Tenn., and Ark.

49. **Crataegus monógyna** Jacq. English Hawthorn. A shrub or tree with ascending branches and numerous thorns. Leaves ovate, sharply 3-15 lobed or cleft, dark green and glabrous above when mature. Fruit globose or subglobose, red. Native of Europe. Sparingly escaped in the eastern states.

50. **Crataegus uniflora** Muench. Dwarf Hawthorn. An

irregular shrub or small tree with numerous, slender, straight thorns. Leaves obovate to spatulate, crenate or crenate-serrate, shining above. Corymbs 1-3 flowered. Fruit ellipsoid, pyriform or globose, greenish-yellow or red. In sandy soil. N. Y. to Fla., west to W. Va., Mo., and Tex.

51. **Crataegus douglásii** Lindl. Douglas' Hawthorn. A shrub or tree with dark brown scaly bark and short thorns. Leaves ovate to obovate, doubly serrate and lobed, dark green and pubescent above. Fruit short-ellipsoid, dark purple; flesh soft, sweet. From Mich. northwestward.

52. **Crataegus phaenópyrum** (L.f.) Medic. Washington Hawthorn. A shrub or small tree with strongly ascending branches, and numerous thorns. Leaves ovate-triangular simply or doubly serrate, often 3-5 lobed, bright green and glabrous above. Fruit depressed-globose, scarlet. Moist rich ground. A very desirable species for cultivation. Va. to Ga., Ill., and Ark. Naturalized northward to N. J., Pa., and Ohio.

Fabaceae. Bean Family.

Cassiatae. Senna Sufamily.

41. **Gymnócladus** Lam. Coffee-bean.

Trees with alternate, evenly bipinnate leaves, sunken superposed axillary buds, and large chocolate-colored pith.

Flowers greenish, diecious, both types with vestiges of the opposite sporophylls; fruit a woody bean.

1. **Gymnocladus dioica** (L.) Koch. Coffee-bean. A large, slow-growing tree with rough bark and few branches. Bean short and thick, the greenish pulp within poisonous. The bruised leaves are used as a fly poison, and the seeds have been used as a substitute for coffee. Wood compact, heavy, rather soft, strong, tough, reddish in color, of coarse texture, and taking a good polish; used to some extent in cabinet-work. In rich soil. Ont. to Ohio and Penn., Tenn., S. Dak., and Okla.

42. **Gledítsia** L. Honey-locust.

Trees with alternate, evenly pinnate or bipinnate leaves, superposed buds beneath the petiole base, and usually with branched axillary thorns.

Flowers small, greenish, imperfectly monosporangiate and diecious; fruit a bean.

1. Pod linear-oblong, many seeded, pulpy within; leaflets short-stalked, oblong-lanceolate or oval, obtuse at both ends, inequilateral at the base. *G. triacanthos*.

1. Pod obliquely oval, 1-seeded, not pulpy; leaflets thicker, darker green, usually larger, ovate-lanceolate or lanceolate, the margin more crenulate. *G. aquatica*.

1. **Gleditsia triacanthos** L. Honey-locust. A large tree of rapid growth, usually with stout branching or simple thorns and with rough bark, the catkin-like racemes often appearing on the main trunk and larger branches. Used as a hedge plant. Autumn leaves pure yellow. Wood heavy, hard, strong and tough; used for fencing, fuel and wagon hubs. Sprouts freely from the roots if disturbed by plowing. Grows well in dry or sandy soil. Ont. and N. Y. to S. Dak., Ga., Kan., and Texas.

2. **Gleditsia aquatica** Marsh. Water Honey-locust. A tree growing in swamps. Thorns usually little branched. Wood very hard and bright reddish-brown. Ind. to Mo., S. Car., Fla., and Texas.

43. **Cercis** L. Redbud.

Trees or shrubs with 2-ranked, entire, palmately veined leaves.

Flowers zygomorphic in short lateral fascicles; stamens 10, distinct; fruit a flat bean.

1. **Cercis canadensis** L. Redbud. A small tree with bright red-purple flowers before the leaves; fine for ornamental purposes. Wood hard and heavy, beautifully variegated. In rich soil. Easily cultivated. Ont. and N. Y. to Iowa, Neb., N. J., Fla., and Texas.

Fabatae. Bean Subfamily.

44. **Cladrastis** Raf. Yellow-wood.

Trees with alternate, odd-pinnate leaves with entire leaflets, with the petiole base covering the superposed buds, and without milky or resinous sap.

Flowers white, showy, fragrant; fruit a slender bean.

1. **Cladrastis lutea** (Mx. f.) Koch. American Yellow-wood. Trees with smooth bark, close like in the beech. Wood light-yellow. In rich soil; much planted. Ky., Mo., Tenn., and N. Car.

45. **Robinia** L. Locust.

Trees or shrubs with alternate odd-pinnate non-punctate leaves and with stipular spines.

Flowers showy, in racemes; fruit a flat bean.

1. Twigs, petioles and pods glabrous or nearly so; flowers white. *R. pseudoacacia*.

1. Twigs and petioles glandular; pods hispid; flowers pinkish. *R. viscosa*.

1. **Robinia pseudoacacia** L. Common Locust. A large slender tree with very rough bark, of rapid growth. Wood very heavy, hard, strong, tough, valuable, and very durable in contact with the ground; used for posts, railroad ties, wagon hubs, furniture, and in ship building. All parts of the plant very poisonous. It is troublesome from sprouting from the roots. Penn. and Ohio to Ga., Iowa, Kan., and Okla.

2. **Robinia viscosa** Vent. Clammy Locust. A small tree with rough bark. Underground parts somewhat poisonous. Wood brown, the sap-wood yellow. Va. to Ga. Also escaped in Middle and Eastern States.

Order, CELASTRALES.

Rhamnaceae. Buckthorn Family.

46. **Rhamnus** (Tourn.) L. Buckthorn.

Shrubs or small trees with alternate, rarely opposite, simple serrate or minutely serrulate leaves, and with berry-like drupes containing 2-4 stones.

Flowers bisporangiate or diecious or imperfectly monosporangiate, small, in small axillary clusters. Twigs sometimes ending in stout thorns.

1. Leaves acute, with 6-10 pairs of lateral veins; nutlets smooth; umbels peduncled; flowers bisporangiate. *R. caroliniana*.

1. Leaves with 3 or 4 pairs of lateral veins, the basal pair prominent; nutlets of the fruit grooved; flowers

diecious or imperfectly monosporangiate. *R. cathartica*.

1. **Rhamnus caroliniàna** Walt. Carolina Buckthorn. A tall thornless shrub or small tree with a globose sweet drupe. In wet soil. Va. and Ohio to Kan., Fla., and Texas.

2. **Rhamnus cathàrtica** L. Common Buckthorn. A shrub or small tree with black injurious fruit. Somewhat thorny and used for hedges. The fruit yields a dye and has powerful medicinal properties. Introduced from Europe. Eastern states.

Celastraceae. Stafftree Family.

47. **Euónymus** (Tourn.) L. Wahoo.

Shrubs or small trees with opposite, simple pinnately veined, serrate leaves, green twigs and central bundle-scars.

Flowers regular, small; fruit a 3-5-locular dehiscent capsule; seeds enclosed in a red aril.

1. Flowers purple; cymes 6-15 flowered; winter buds long-pointed with long bud scales. *E. atropurpureus*.

1. Flowers greenish-yellow; cymes 3-7-flowered; winter buds very short pointed with short bud scales. *E. europæus*.

1. **Euonymus atropurpùreus** Jacq. Wahoo. A high shrub or small tree with green, obtusely 4-angled twigs. Leaves dark red and fruit very ornamental in autumn. Self-prunes small twigs by basal joints. Wood nearly white. Ont. to Fla., Mont. and Okla.

2. **Euonymus europàeus** L. Spindletree. A shrub or small tree resembling the preceding. Self-prunes twigs. Cultivated from Europe. Escaped. N. Y., N. J. and Va.

Ilicaceae. Holly Family.

48. **Ilex** L. Holly.

Shrubs or trees with alternate, not two-ranked, simple, pinnately-veined, serrate or lobed leaves which are sometimes evergreen; with watery sap; and with berry-like drupes containing several small stones.

Flowers small, in axillary clusters or solitary, mostly imperfectly dioecious.

1. Leaves thick, persistent, evergreen, shiny. *I. opaca*.
1. Leaves thin, deciduous, not spiny. 2.
2. Leaves small, obovate or spatulate, crenate; nutlets of the fruit ribbed. *I. decidua*.
2. Leaves large, ovate or lanceolate, sharply serrate, nutlets ribbed. *I. montana*.

1. **Ilex decidua** Walt. Deciduous Holly. A shrub or small tree with light-gray, glabrous twigs and red drupes. Wood hard and white. In swamps and low ground. D. C. to Fla., Kan., and Texas.

2. **Ilex montana** (T. & G.) Gr. Mountain Holly. A shrub or slender, erect tree growing in mountain woods. Drupes red. N. Y. to Ga., and Ala.

3. **Ilex opaca** Ait. American Holly. A tree of slow growth with thick, glabrous, evergreen leaves and globose red or rarely yellow drupes. Twigs with leaves and fruit much used for Christmas decoration. Wood very white, fine-grained, hard, strong, tough, light in weight, and easily worked; used for cabinet-work and in turnery. Bird-lime is prepared from the middle bark. In moist soil. Should be much planted for ornament in suitable places. The leaves should be cut off when transplanted. Me. to Fla., Penn., Mo., and Texas.

Ilex aquifolium L. is the European Holly, sometimes cultivated.

Order, SAPINDALES.

Staphyleaceae. Bladdernut Family.

49. **Staphylèa** L. Bladdernut.

Shrubs or small trees with opposite trifoliate serrate leaves.

Stipules caducous; flowers in axillary racemes or panicles, white bisporangiate, regular; capsule large and bladdery, triangular.

1. **Staphylea trifolia** L. American Bladdernut. A shrub or rarely small tree with smooth striped bark. Branching a sympodial dichotomy. In moist soil. Quebec to Minn., S. Car. and Kan.

Sapindaceae. Soapberry Family.50. **Sapindus** (Tourn.) L. Soapberry.

Trees or shrubs with alternate odd-pinnate leaves, with entire, inequilateral, acuminate leaflets, and with solid pith; with axillary, exposed, superposed buds; and without stipular spines.

Flowers imperfectly diecious; fruit a 1-3-seeded berry.

1. **Sapindus drummondii** H. & A. Drummond Soapberry. A tree with white flowers in dense terminal panicles and very saponaceous, globose berries. Wood hard, light yellowish brown; used in Texas for cotton baskets. Kan. and Mo. to La. and Ariz.

51. **Koelreutèria** Laxm.

Trees with alternate, odd-pinnate or bipinnate leaves with the leaflets toothed and usually more or less cut and lobed; without prickles, stipules, or terminal buds, but with numerous scattered bundle-scars and large cylindrical pith.

Flowers yellow diecious, in large terminal panicles; fruit a trilocular bladderly capsule; outer bud-scales 2.

1. **Koelreuteria paniculàta** Laxm. Chinese Varnish-tree. A tree much planted for ornament. Reported as spontaneous from seed in Indiana.

Aesculaccae. Buckeye Family.52. **Aésculus** L. Buckeye, Horse-chestnut.

Trees or shrubs with opposite palmately compound leaves.

Flowers imperfectly monosporangiate, zygomorphic, in terminal panicles, capsules leathery, containing large shining nut-like seeds.

1. Flowers white, mottled with yellow and purple; leaflets abruptly acuminate; winter buds gummy; capsule spiny; bundle scars arranged in a curved line.
A. hippocastanum.

1. Flowers yellow or purplish; leaflets acuminate, more or less abrupt; winter buds not gummy; bundle scars arranged in 3 areas. 2.

2. Capsule spiny, stamens exserted. 3.

2. Capsule glabrous; stamens not longer than the petals, corolla yellow or purplish. *A. octandra*.
3. Leaflets acuminate, finely serrate, 5-7; a tree. *A. glabra*.
3. Leaflets long-acuminate, unequally serrate, 7-9; a shrub-like small tree. *A. arguta*.

1. **Aesculus hippocástanum** L. Horse-chestnut. A large tree with very resinous, gummy winter buds. Autumn leaves orange. The seeds are poisonous and symptoms of poisoning have been produced from eating the green rind. The twigs contain Aesculin which is fluorescent in aqueous solution. Escaped from cultivation; native of Asia.

2. **Aesculus glàbra** Willd. Ohio Buckeye. A large tree with rough and fetid bark. Leaves, young shoots, and seeds poisonous to cattle. Wood light and hard to split; used for making artificial limbs, wooden-ware, and paper pulp. Penn. to Ala., Mich., Neb., and Okla.

3. **Aesculus argùta** Buckl. Western Buckeye. A shrub-like small tree with smooth bark. On flood plains. Neb. and Kan. to Texas. Reported from Iowa.

4. **Aesculus octáandra** Marsh. Yellow Buckeye. A large tree with brown scaly bark. Seeds poisonous. Wood light and hard to split; used for making artificial limbs, wooden-ware and paper pulp. **Aesculus octandra hybridia** (DC.) Sarg. has purplish or pink flowers, leaflets pubescent beneath, and light brown bark. Penn. to Ga., Iowa and Texas.

Accraceae. Maple Family.

53. **Àcer** (Tourn.) L. Maple.

Trees or shrubs with opposite leaves, with 3-5 bundle scars in the narrow, contiguous leaf-scars, and with a terminal bud showing several pairs of visible scales.

Sap watery or sometimes milky, often saccharine; fruit a 2-winged samara. Usually diocious or imperfectly diocious.

1. Leaves pinnate or trifoliate; twigs green, glaucous.
A. negundo.
1. Leaves simple. 2.

2. Leaves with very large teeth or lobes, the divisions not serrate or serrate-dentate. 3.
2. Leaves with the large divisions or lobes serrate or serrate-dentate. 5.
3. Leaves with stipules which are often large and foliaceous; leaves green and pubescent beneath at least on the veins; flowers corymbose, unfolding with the leaves; wings of fruit diverging a little less than a right angle. *A. nigrum*.
3. Leaves without stipules. 4.
4. Leaves with much milky sap in the petiole, glabrous, dark green above, lighter below, usually with 7 prominent palmate veins; flowers corymbose, unfolding with the leaves; wings of the fruit diverging nearly in a straight line; petals present; winter buds rounded. *A. platanoides*.
4. Leaves with watery or frothy sap, pale and nearly glabrous beneath, usually with 5 prominent palmate veins; flowers corymbose, unfolding with the leaves; wings of the fruit diverging a little less than a right angle; petals none; winter buds pointed. *A. saccharum*.
5. Leaves very sharply and finely serrate, 3-lobed at the outer end, widest above the middle, the lobes abruptly narrow-acuminate, brown pubescent below when young; twigs green, striped with darker lines; flowers racemed, terminal, unfolding after the leaves. *A. pennsylvanicum*.
5. Leaves dentate-serrate or lobed, not abruptly narrow-acuminate; twigs not striped. 6.
6. Leaves broadly 3-5-lobed, the lobes rather regularly and continuously dentate-serrate or dentate-crenate; flowers racemed, terminal, unfolding after the leaves. 7.
6. Leaves usually with 3-7 slender, long and pointed lobes, the lobes irregularly or interruptedly serrate or serrate-dentate; flowers in dense sessile lateral clusters, appearing before the leaves. 8.
7. Leaves longer than wide, slightly 3-lobed at the outer end, usually only very slightly lobed at the lower

end, not glaucous below; bark of twigs green or grayish; racemes erect; a shrub, rarely a small tree. *A. spicatum*.

7. Leaves as broad or broader than long, prominently 5-lobed, glabrous and dark green above, pubescent and light glaucous below, on long reddish petioles; bark of twigs reddish-brown; racemes drooping; wings of fruit pubescent, moderately spreading; a large tree. *A. pseudo-platanus*.
8. Leaves usually deeply 5-lobed, lobes slender, acute, white and glaucous beneath; notches between the lobes often somewhat rounded; fruiting pedicel short and stiff, 1-2 in. long; wings divergent; petals none. *A. saccharinum*.
8. Leaves sharply 3-5 lobed, whitish glaucous beneath, notches acute; fruiting pedicel long, slender and drooping, 2-4 in. long; wings incurved; petals present. *A. rubrum*.

1. *Acer platanoides* L. Norway Maple. A medium-sized tree with a broad rounded crown, with brown twigs and milky sap. Leaves sharply 5-7 lobed, very dark green above. Much cultivated.

2. *Acer pseudo-platanus* L. Sycamore Maple. A fine tree with spreading branches. Leaves deeply 3-5 lobed. Self-prunes. Much cultivated.

3. *Acer pennsylvanicum* L. Striped Maple. A small tree with smoothish green bark striped with darker lines. Leaves broadest above the middle, thin, glabrous above, slightly pubescent beneath when young, truncate or somewhat cordate at the base, 3-lobed near the apex. Wood white and soft. In rocky soil. N. S. to Lake Superior, and along the mountains to Ga. and Tenn.

4. *Acer spicatum* Lam. Mountain Maple. A shrub or small tree, the bark green but not striped. Leaves 3-5-lobed, the lobes acute or acuminate, glabrous above, pubescent beneath, at least when young. In damp rocky woods. Newf. to Man., south to N. Car., Tenn., Minn., and Iowa.

5. *Acer saccharum* Marsh. Sugar Maple. A large tree with yellow or sometimes red leaves in autumn. Leaves

cordate or truncate at the base, 3-7 lobed, the lobes, acuminate, irregularly sinuate, dark green above, pale and nearly glabrous beneath. Its sap is the main source of maple sugar and syrup. An average tree will yield 2-10 lbs. of sugar a season. A fine shade tree. The ashes give large quantities of potash. Wood heavy, hard, strong and tough; used for fuel, interior finish, furniture, keels of boats and ships, implements and machinery, sucker rods, rims of bicycle wheels, piano action, school apparatus, large wood type, tool and broom handles, and wood carving. Newf. to Man., south to Fla. and Texas.

6. **Acer nigrum** Mx. f. Black Maple. A large fine tree with rough blackish bark. Leaves cordate or truncate at the base, 3-7-lobed, the lobes broad and short, green on both sides, generally more or less pubescent beneath. It is equally valuable for the making of sugar. Wood much the same as in the Sugar Maple, and used for the same purposes. Ont. and Vt. to Ga., S. Dak., Ia., and Ark.

7. **Acer rubrum** L. Red Maple. A tree with flaky or smoothish bark and reddish twigs. Leaves sharply 3-5-lobed, the lobes irregularly dentate, acute or acuminate, cordate at the base, green above, whitish beneath. Wood of considerable value when it shows a "curly grain." Leaves crimson, scarlet or yellow in the autumn. Self-pruning like the following. Exists in many varieties. In swamps and low ground, also on moist hillsides. N. S. to Man., Fla., Neb., and Texas.

8. **Acer saccharinum** L. Silver Maple. A large tree with flaky bark, the twigs often reddish, self-pruned by basal joints. Leaves deeply 5-lobed, the lobes rather narrow, acuminate, coarsely and irregularly dentate, truncate or slightly cordate at the base, green above, silvery white and more or less pubescent beneath. A fine shade tree and much planted. Wood soft and white; used for furniture. Yields a small amount of sugar. Along streams. N. B. to Fla., Ont., S. Dak., Neb., and Okla.

9. **Acer negundo** L. Boxelder. A small tree with spreading branches and glabrous, sometimes pubescent, green and glaucous twigs. Leaves 3-7 foliate, leaflets ovate or oval. The sap produces a slight amount of sugar. Wood light and of slight value. Along streams. Planted on the prairies for

small groves and wind breaks. Maine to Man., Fla., Kan., and Mex.

Anacardiaceae. Sumac Family.

54. **Rhús** (Tourn.) L. Sumac.

Small trees or shrubs with alternate pinnately compound leaves, with sticky milky or resinous sap, and pubescent drupes.

Flowers in panicles, imperfectly bisporangiate, small; stamens five, styles three; drupe red.

1. Petioles not completely covering the axillary buds; leaflets entire; rachis of the leaf wing-margined; leaflets 7-31; twigs and the red drupes pubescent.

R. copallina.

1. Petioles covering the axillary buds; leaflets serrate. 2.

2. Leaves and twigs velvety-pubescent. *R. hirta*.

2. Leaves and twigs glabrous, somewhat glaucous. *R. glabra*.

1. **Rhus copallina** L. Mountain Sumac. A shrub or small tree with a dense terminal panicle of small globose, crimson drupes, covered with short acid hairs. Leaves used for tanning purposes. Wood soft and light brown. In dry soil. Me. and Ont. to Fla., Minn., Neb., and Texas.

2. **Rhus hirta** (L.) Sudw. Staghorn Sumac. A small tree or shrub with red, pubescent drupes. Wood very soft and brittle. In dry or rocky soil. A good lemonade or "sumacade" is made by steeping the drupes and sweetening to taste. Leaves used for tanning. Wood soft, greenish-yellow. N. S. to Ga., Ont., S. Dak., Mo., and Iowa.

3. **Rhus glabra** L. Smooth Sumac. A shrub or small tree with dense panicles of small crimson drupes covered with short acid hairs. Noted for its beautiful, brilliant, red-colored leaves in autumn. Leaves used for tanning. Common on hill-sides and bluffs. N. S. to Minn., Fla., Miss., and La.

55. **Toxicodéndron** (Tourn.) Mill. Poison Sumac.

Small trees or shrubs, ours with alternate pinnate leaves with entire leaflets, with poisonous resinous sap, and with glabrous or slightly pubescent drupes.

Flowers small, in axillary panicles, imperfectly bisporangiate; drupes gray or white.

1. **Toxicodendron vèrnix** (L.) Ktz. Poison Sumac. A shrub or small tree, very poisonous to the touch. Drupes gray, glabrous in loose axillary panicles. In swamps and wet places. Wood soft, yellowish brown, poisonous. Maine to Fla., Ont., Minn., Mo., and La.

56. **Cótinus Adans.** Smoketree.

Small trees or shrubs with alternate, simple pinnately veined, entire, deciduous leaves and fragrant resinous sap.

Flowers small, imperfectly bisporangiate, on a large terminal panicle; stamens 5, styles 3, lateral; drupe oblique, small, compressed; buds clustered at the tip of the twig.

1. Blade of the leaf slightly decurrent on the petiole, thin, glabrous or slightly pubescent beneath. *C. Americànus*.

1. Leaves mostly rounded or obtuse at the base, coriaceous more pubescent. *C. coggygria*.

1. **Cotinus americànus** Nutt. American Smoketree. A small wide-branched tree. Wood soft, orange-yellow, yielding a rich dye. Mo. and Okla. to Tenn. and Ala.

2. *Cotinus coggygria* Scop. European Smoketree. A small tree, native of Europe, frequently cultivated.

Subclass, AMENTIFERAE.

Order, PLATANALES.

57. **Hamamèlis** L. Witch hazel.

Subfamily, *Hamamelidatae*.

57. *Hamamèlis* L. Witch-hazel.

Shrubs or small trees with 2-ranked, simple, inequilateral, straight-veined leaves and stalked axillary buds.

Flowers bisporangiate or imperfectly bisporangiate, in axillary clusters; fruit a bilocular, woody or cartilaginous, nut-like capsule.

1. **Hamamelis virginiana** L. Witch-hazel. A shrub or small tree with 2-ranked leaves and stalked buds. Blooms

in late autumn. Wood hard. In low ground and on banks. N. B. and N. S. to Minn., Mo., Fla., and Texas.

Subfamily, *Altingiatae*.

58. **Liquidámbar** L. Sweet-gum.

Trees with alternate, simple, palmately veined, fragrant, star-shaped, serrate leaves and 5-angled pith.

Sap resinous, aromatic; flowers monocious, in heads, the staminate clusters racemose; capsules in a dense spiny glo-bular head.

1. **Liquidambar styraciflua** L. Sweet-gum. A fine large tree with wide spreading branches, the twigs often covered with corky ridges. Leaves with a peculiar sweet fragrance when crushed. Autumn leaves red, yellow, and brown. Wood valuable, of medium weight, hard, not strong, tough, and of fine texture, reddish brown, difficult to season. Sometimes used as a substitute for black walnut. Used for furniture, veneer, wooden plates, plaques, baskets, hat blocks and wagon hubs. In low ground. Conn., N. Y. and Ohio to Fla., Ill., Mo., and Mex.

Platanaceae. Planetree Family.

59. **Plátanus** (Tourn.) L. Planetree.

Large trees with alternate simple leaves having the base of the petiole cover the axillary bud and with complete stipular rings.

Terminal bud self-pruned; flowers in spherical heads monocious, without perianth; fruit in pendant spherical heads composed of numerous small nutlets.

1. Bark exfoliating in large flakes; leaves usually deeply lobed, or the middle lobe about as long as broad; fruit heads usually 2 or more on the peduncle. 2.
1. Bark exfoliating in small plates; leaves 5-angled or slightly 3-5-lobed, the lobes broader than long; fruit heads solitary on the peduncle. *P. occidentalis*.
2. Leaves deeply 5-7-lobed, the sinuses reaching to or beyond the middle; fruit heads on the peduncle 2-6. *P. orientalis*.

2. Leaves 3-5-lobed, the middle lobe of the leaf about as long as broad; fruit heads on the peduncle usually 2.
P. acerifolia.

1. **Platanus occidentàlis** L. Sycamore (Planetree). A very large tree, the largest in the northeastern United States, with whitish or green bark which peels off freely in thin plates; the largest trunks usually hollow, sometimes as much as 42 feet in circumference. Autumn leaves brown. Wood rather hard, compact, coarse-grained, difficult to split, tough, and of a light-brown color; used for tobacco boxes, cooperage, cabinet-work, and finishing lumber. Along the banks of streams and in moist ground, but grows well in ordinary mesophytic conditions. Me. to Ont. and Minn., Fla., Kan., and Texas.

2. *Platanus acerifolia* Willd. London Planetree. A tall tree with erect, straight trunk and wide-spreading branches, the lower drooping. Young growth densely brown-tomentose, the mature leaves glabrous or nearly so. Much planted as a street tree.

3. *Platanus orientàlis* L. Oriental Planetree. A large tree much like the Sycamore but usually with a comparatively short, massive trunk and a broad round crown. Leaves more cut and becoming smooth earlier. Occasionally planted. From Western Asia and Eastern Europe.

Order, URTICALES.

Ulmaceae. Elm Family.

60. **Céltis** (Tourn.) L. Hackberry.

Trees or shrubs with 2-ranked, simple, leaves with two prominent lateral veins from the base and with interruptedly diaphragmed pith with cavities.

Flowers in the axils of leaves, on short branches; fruit an ovoid or globose drupe.

1. Leaves sharply serrate; smooth or scabrous above; twigs glabrous, especially the fruiting ones, or pubescent. *C. occidentalis*.

1. Leaves entire or few-toothed, small. *C. laevigata*.

1. **Celtis occidentàlis** L. Common Hackberry. A medium sized tree with rough bark. Commonly much distorted

with "witches brooms." Drupe sweet and edible. Self-prunes the fruiting twigs in winter. Wood heavy, hard, strong, quite tough, greenish-white. In dry soil and on flood plains. Quebec to Man., N. Car., Mo., Kan., and Okla.

2. **Celtis laevigata** Willd. Southern Hackberry. A medium-sized tree with light gray, rough bark. Usually in dry soil. Va. to Ill., Mo., Kan., Fla., and Texas.

61. **Plánera** Gmel. Planertree.

Trees with alternate, two-ranked, straight-veined, inequilateral, serrate leaves and with bark scaling off in plates.

Trees similar to the elms but with a nut-like fruit and the flowers expanding with the leaves.

1. **Planera aquática** (Walt.) Gmel. Planertree. A small tree with nearly glabrous leaves growing in swamps and on wet banks. Wood compact, soft, weak, light brown. Ind. to Mo., Ky., N. Car., Fla., and Texas.

62. **Ulmus** (Tourn.) L. Elm.

Trees with alternate, 2-ranked, pinnately straight-veined, inequilateral, doubly serrate leaves and sessile axillary buds.

Flowers bisporangiate or imperfectly bisporangiate, in clusters or racemes; fruit a samara; trees of rapid growth.

1. Leaves very rough above; twigs not corky-winged and not self-pruned, but large numbers of lateral buds cut off; inner bark sometimes mucilaginous. 2.
1. Leaves smooth or sometimes somewhat rough above. 3.
2. Inner bark very mucilaginous, buds rusty-downy, samara much less than 1 in. long. *U. fulva*.
2. Inner bark not mucilaginous, buds not downy, samaras 1 in. long. *U. montana*.
3. None of the branches corky-winged; twigs smooth, self-pruned by basal joints and by cleavage planes in the nodes of annual growth; samara faces glabrous. *U. americana*.
3. None of the branches with corky ridges; twigs glabrous or nearly so, not self-pruned; samara glabrous or nearly so, deeply notched. *U. campestris*.
3. Some or all of the branches corky-winged, or twigs

- puberulent, self-pruned; samara-faces pubescent. 4.
4. Most of the branches with corky wing-like ridges; twigs glabrous or nearly so; leaves 1-3 in. long. *U. alata*.

4. Branches often with corky wing-like ridges; twigs puberulent; leaves 2-5 in. long. *U. thomasi*.

1. ***Ulmus americana*** L. White Elm. A large tree of rapid growth, with the bark in thick, rough ridges; much cultivated in cities and along roadsides. Trunks up to 33 feet in circumference. Samara ovate-oval, its faces glabrous. Wood heavy, hard, flexible, and very tough; used for wheel-hubs, saddle-trees, rough cooperage and furniture, in boat and ship building, in the construction of cars and wagons, and especially for barrel hoops. Common on bluffs and on the flood plains of rivers and creeks. Graceful in form and very suitable for cultivation. Newf. to Man., Fla., and Texas.

2. ***Ulmus thomasi*** Sarg. Cork Elm. A large tree with puberulent young twigs, the branches or some of them with corky wings. Samara oval, its margins densely ciliate. Wood harder, stronger, and more durable than that of the White Elm. In rich soil. Quebec to Ont., Minn., Ky., Neb., and Mo.

3. ***Ulmus alata*** Mx. Winged Elm. A small tree, branches usually with corky wing-like ridges; twigs glabrous or nearly so. Samara oblong, pubescent on the faces. Wood very compact; used for wheel hubs. In dry or moist soil. Va. to Fla., Ill., Mo., and Texas.

4. ***Ulmus campestris*** L. English Elm. A tree, rather pyramidal in shape, the twigs ascending, not drooping except in "weeping" forms. Samara not ciliate, nearly or quite glabrous. A good timber tree. Cultivated, from Europe.

5. ***Ulmus fulva*** Mx. Slippery Elm. A medium-sized tree with rough grayish-brown fragrant bark and rough-pubescent twigs. Samara oval-orbicular, pubescent over the seed. Inner bark mucilaginous and medicinal. Wood hard and strong but splitting easily when dry. Along streams, on flood plains and on hills. Quebec to N. Dak., Fla., and Texas.

6. ***Ulmus montana*** With. Scotch Elm. A large tree with spreading branches, or in some varieties with strictly upright

branches; branchlets pubescent. Leaves rough above, pubescent beneath, doubly serrate, often somewhat 3-lobed at the apex. Many varieties fine for planting. From Europe.

Ulmus pumila L. Chinese Elm. This tree is being extensively planted in the prairie states.

Moraceae. Mulberry Family.

63. *Morus* (Tourn.) L. Mulberry.

Trees or shrubs with alternate, simple, 2-ranked leaves with two prominent side ribs from the base, with milky sap, and with glabrous or pubescent but not downy twigs.

Flowers monosporangiate; fruit aggregate, berry-like.

1. Leaves scabrous above, pubescent beneath. *M. rubra*.

1. Leaves smooth and glabrous on both sides, or nearly so.

M. alba.

1. *Morus rubra* L. Red Mulberry. A small monoecious or dioecious tree with rough gray bark, separating in strips. Fruit dark purple-red, edible, delicious. Wood rather heavy, hard, strong, and rather tough; very durable in contact with the ground, very valuable for posts; used for farm implements, in cooperage, "acid wood," and ship building. In rich soil. Vt. and Ont. to Mich., S. Dak., Fla., and Texas.

2. *Morus alba* L. White Mulberry. A small rapid-growing tree with rough light-gray bark and spreading branches. Fruit edible but usually rather insipid. Leaves used for feeding silk-worms. Wood suitable for posts. Although growing best in rich moist soil, it does well in quite dry regions and should be much planted on the dry prairies, especially varieties with the better grade of berries. Introduced from the old world. Me. and Ont. to Fla., and Kan.

Morus nigra L. Black Mulberry. A small tree with broadly cordate-ovate leaves, from Asia and Europe, is sometimes planted toward the south for its large purple or black fruit.

64. *Broussonetia* L'Her. Paper-mulberry.

Trees with alternate simple 2-ranked leaves having two prominent side-ribs from the base, with milky sap, and with downy twigs.

Flowers diecious, the staminate in ament-like spikes, the carpellate capitate; fruit a globular head of red drupes.

1. **Broussonetia papyrifera** (L.) Vent. Paper-mulberry. (*Papyrius*.) A small, low-branching large-headed tree with dark scarlet fruit which is sweet but insipid. Native of eastern Asia. In Japan and China the bark is made into paper. Escaped from cultivation. N. Y. to Ga., and Mo.

65. **Maclura** Nutt. Osage-orange.

Small trees with alternate simple entire leaves, typical axillary thorns, and milky sap.

Flowers decious, the staminate racemose, the carpellate capitate; fruit a large spherical, greenish or yellowish aggregate.

1. **Maclura pomifera** (Raf.) Schn. Osage-orange. (*Toxylon*.) A very thorny tree much planted for hedges. Leaves ovate to ovate-lanceolate, acuminate or taper-pointed. Wood very heavy, exceedingly hard and strong, but not tough, brownish-yellow; valuable for fence posts and fire wood, also for wagon making. The thorns produce painful wounds. Horses acquire a strong liking for the young shoots and eat them in large quantities without apparent ill effects. Mo. and Kan. to Texas. Escaped in Ohio and other eastern states.

Order, FAGALES.

Fagaceae. Beech Family.

66. **Quercus** (Tourn.) L. Oak.

Trees or shrubs with simple alternate leaves not 2-ranked; with 5-angled pith: buds clustered at the tip of the twig; and with scattered bundle-scars.

Flowers monocious, the staminate in slender aments; fruit a 1-seeded coriaceous nut (acorn) in an involucrate cup.

1. Leaves not bristle-tipped; acorns maturing the first year. 2.

1. Leaves with bristle-tips; acorns maturing in the autumn of the second year. 11.

2. Leaves crenate or dentate, not lobed. 3.

2. Leaves pinnatifid or pinnately lobed. 7.

3. Fruits not on a peduncle, nearly sessile, teeth or shallow lobes of the leaves acute. 4.
3. Fruits on a peduncle; teeth or shallow lobes of the leaves rounded. 5.
4. Tall trees, leaves oblong, obovate or lanceolate. *Q. muhlenbergii*.
4. Shrub or low tree, leaves obovate or oval; seed edible. *Q. prinoides*.
5. Peduncle as long or shorter than the petioles; leaves gray-tomentulose beneath. 6.
5. Peduncle much longer than the petioles; leaves white-tomentulose beneath. *Q. bicolor*.
6. Teeth of the leaves acute or mucronulate; bark white, flaky; seed sweet and edible; fruit short peduncled or sometimes nearly sessile. *Q. prinus*.
6. Teeth of the leaves rounded; bark close; seed edible; petioles slender; peduncles equaling or shorter than the petioles. *Q. montana*.
7. Mature leaves pale, or glaucous and glabrous below. 8.
7. Mature leaves pubescent or tomentose below, lyrate-pinnatifid. 9.
8. Bark separating in thin scales, light gray or light brown; cup shallow; bracts thick and warty. *Q. alba*.
8. Bark furrowed and ridged, not scaly, dark gray or dark brown; cup hemispherical, with imbricated, appressed scales; cultivated in many varieties. *Q. robur*.
9. Leaves pubescent beneath, oblong-obovate, usually 5-lobed, stellate-pubescent above; upper scales of the cup not awned. *Q. stellata*.
9. Leaves white-tomentulose beneath. 10.
10. Leaves obovate or oblong, lyrate pinnatifid or deeply sinuate-lobed; upper scales awned, forming a fringe around the acorn. *Q. macrocarpa*.
10. Leaves obovate-oblong, deeply 5-9-lobed; acorn often nearly enclosed in the cup, the upper scales not awned. *Q. lyrata*.
11. Leaves entire, oblong, linear-oblong or lanceolate. 12.
11. Leaves 3-5 lobed above the middle, or entire, obovate or spatulate in outline. 13.

11. Leaves pinnatifid or pinnately lobed. 14.
12. Leaves oblong or lanceolate, tomentulose beneath. *Q. imbricaria*.
12. Leaves linear-oblong, green and glabrous on both sides. *Q. phellos*.
13. Leaves spatulate, glabrous on both sides; cup saucer-shaped, acorn globose-ovoid. *Q. nigra*.
13. Leaves obovate-cuneate, brown-floccose beneath; cup deep, acorn ovoid. *Q. marilandica*.
14. Leaves white or gray-tomentose below. 15.
14. Leaves green on both sides. 17.
15. Leaf-lobes lanceolate or linear-lanceolate, long; large trees. 16.
15. Leaf-lobes triangular-ovate, short; shrubs or low trees. *Q. ilicifolia*.
16. Leaves rounded or obtuse at the base, 3-5 lobed; lobes linear or lanceolate, often falcate. *Q. rubra*.
16. Leaves cuneate to truncate at the base, 5-11 lobed; lobes triangular. *Q. pagoda*.
17. Leaves usually pubescent below; winter buds tomentose; cup turbinate or hemispherical; inner bark orange. *Q. velutina*.
17. Leaves glabrous with the exception of tufts of hairs in the axils of the veins below; winter buds glabrous or minutely pubescent. 18.
18. Cup of the acorn top-shaped or hemispheric. 19.
18. Cup of the acorn saucer-shaped, much broader than deep. 20.
19. Leaves dull, paler beneath; acorn ovoid, cup depressed-hemispheric, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide. *Q. borealis*.
19. Leaves shining above; cup of acorn top-shaped, about $\frac{1}{2}$ in. wide, covering $\frac{3}{4}$ - $\frac{1}{2}$ the nut. *Q. ellipsoidalis*.
19. Leaves shining on both sides, lobed to near the mid-rib; acorn ovoid; cup top-shaped, $\frac{3}{4}$ -1 in. wide. *Q. coccinnea*.
20. Leaves dull; cup $\frac{3}{4}$ -1 in. broad; acorn ovoid or elongated. *Q. maxima*.
20. Leaves shining above, paler beneath, with prominent axillary tufts of hairs; acorn ovoid, the cup deeply saucer-shaped. *Q. schneckii*.

20. Leaves shining, deeply pinnatifid; cup $\frac{1}{2}$ - $\frac{1}{2}$ in. broad; acorn subglobose or ovoid. *Q. palustris*.

Chestnut Oaks.

1. **Quercus montana** Willd. (*Q. prinus* Du Roi not L.) Rock Chestnut Oak. A large tree with brown bark, ridged close or slightly flaky. Leaves oblong, oblong-lanceolate, or obovate, coarsely crenate, glabrous above, finely gray-tomentulose beneath, petioles slender; cup hemispheric, $\frac{1}{2}$ - $1\frac{1}{4}$ in. broad, peduncles equalling or shorter than the petioles; acorn ovoid, 2-3 times as high as the cup, seed edible but not very sweet. Self-prunes. Wood hard and strong; used in fencing and for railroad ties. Bark rich in tannin. In dry soil. Me. to Ont., Ala., and Tenn.

2. **Quercus prinus** L. (*Q. michauxii* Nutt). Cow Oak. A large tree with flaky white bark. Leaves obovate or broadly oblong, crenately toothed, the teeth often mucronulate, 4-8 in. long, cup depressed-hemispheric, short-peduncled, $1-1\frac{1}{4}$ in. broad; acorns ovoid, about 3 times as high as the cup, sweet and edible. Wood valuable like the White Oak. In moist soil. Del. to Ind., Mo., Ark., Fla., and Texas.

3. **Quercus muhlenbergii** Engelm. Chestnut Oak. A tree with close gray bark. Leaves oblong, lanceolate, or obovate, coarsely toothed with acute teeth, shining above, pale and gray-tomentulose beneath, 4-6 in. long; cup sessile or very short-peduncled, hemispheric; acorn ovoid about twice as high as the cup, sweet and edible. Self-prunes abundantly. Wood strong and durable, much like White Oak. Usually in dry soil, commonly on limestone ridges. Vt. and Ont. to Minn., Ala., Neb., and Texas.

4. **Quercus prinoides** Willd. Scrub Chestnut Oak. A shrub or small tree with gray bark. Leaves obovate, coarsely toothed, bright green and shining above, gray-tomentulose beneath, narrowed at the base; cup sessile, hemispheric, thin; acorn ovoid, 2-3 times as long as the cup; seed sweet and edible. Self-prunes. In dry sandy or rocky soil. Me. to Minn., Kan., Ala., and Texas.

5. **Quercus bicolor** Willd. Swamp White Oak. A large tree with flaky gray bark. Leaves obovate, or oblong-

obovate, coarsely toothed or sometimes lobed nearly to the middle, dull and glabrous above, densely white-tomentulose beneath; peduncles of the hemisphere cup 2-5 times as long as the petioles; acorn oblong ovoid, seed rather sweet. Self-prunes. Wood similar in value to that of the White Oak. In moist or swampy soil. Quebec to Minn., Ga., and Ark.

White Oaks

6. **Quercus álba**. L. White Oak. A large tree with a trunk up to 21 feet in circumference and with light-gray bark scaling off in thin plates. Leaves obovate, pinnatifid, lobes oblong, toothed or entire; cup depressed-hemispheric, its bracts thick and warty, appressed; acorn ovoid-oblong, 3-4 times as high as the cup, sweet and edible. Autumn leaves red and russet. Self-prunes extensively. Wood light-colored, hard and tough; valuable for many purposes; an ideal wood for railroad ties; used for poles, posts, and piling, for fuel and "acid wood," for cooperage, furniture, interior finishing lumber, farm implements, wharves, ship building, and car and wagon work. The most valuable of the American oaks. Hybridizes with *Q. macrocarpa*, *Q. stellata* and *Q. montana*. Me. to Ont., Minn., Fla., Kan., and Texas.

7. **Quercus robur** L. English Oak. A large strong tree with stout more or less spreading branches forming a broad round-topped head; self-prunes. Many forms are cultivated for ornament, including yellow-leaved and cut-leaved varieties, also forms with varied branches. Native of Europe.

8. **Quercus stellata** Wang. Post Oak. A shrub or usually a small tree with a long tap root and with rough gray bark and valuable wood. Leaves broadly obovate, deeply lyrate-pinnatifid, glossy and stellate-pubescent above, brown-tomentulose beneath, 4-8 in. long; cup hemispheric, nearly sessile; acorn ovoid, 2-3 times as long as the cup, very sweet. In dry soil. Mass. to Ohio, Mich., Iowa, Fla., and Texas.

9. **Quercus lyrata** Walt. Overcup Oak. A large tree with gray or reddish bark in thin plates. Leaves obovate, lyrate-pinnatifid or lobed to beyond the middle, 6-8 in. long, shining above, densely white-tomentulose beneath, cup depressed-globose, peduncled, 1-1½ in. broad; acorn depressed-

globose, nearly or quite immersed in the cup. Wood like in white oak. In swamps. N. J. to Ind., Mo., Fla., and Texas.

10. **Quercus macrocarpa** Mx. Bur Oak. A large tree with bark in narrow rough ridges, slightly flaky, and with a long tap root. Leaves obovate or oblong-obovate, irregularly lobed, pinnatifid, or coarsely crenate shining above, grayish-white-tomentulose beneath, 4-8 in. long; cup short peduncled or sessile, hemispheric or subglobose, $\frac{1}{2}$ -1 in. broad, the tips of the bracts forming a fringe around the acorn; acorn ovoid, 1-2 times as high as the cup. Self-prunes abundantly. A very valuable tree with hard and tough wood resembling the White Oak. In rich soil or on river bluffs where it is sometimes small and shrubby. N. S. to Man., Mass., Ga., Wyo., Kan., and Texas.

Willow Oaks

11. **Quercus imbricaria** Mx. Shingle Oak. A large stout tree, the leaves dying off but remaining on the tree until about April 1. Leaves oblong or lanceolate, entire, persistently gray-tomentulose beneath, 3-7 in. long; cup hemispheric or turbinate, about $\frac{1}{2}$ in. broad; acorn subglobose, bitter. Wood poor; used for shingles and clapboards. Self-prunes twigs by means of basal joints. *Q. leana* Nutt. is a hybrid of this and *Q. velutina*. *Q. tridentata* Englem. is a hybrid with *Q. marilandica*. Also hybridizes with *Q. palustris*. Pa. to Mich., Neb., Ga., and Ark.

12. **Quercus phellos** L. Willow Oak. A tree with slightly roughened, reddish-brown bark. Leaves narrowly-oblong or oblong-lanceolate, entire, very short petioled; cup saucer-shaped, nearly flat on the base; acorn subglobose, bitter. Wood poor. In moist woods. Hybridizes with *Q. ilicifolia* and probably with *Q. maxima*, producing the form known as *Q. heterophylla*. L. I. to Fla., Ky., Mo., and Texas.

Black Oaks

13. **Quercus nigra** L. Black Water Oak. A tree of rapid growth with gray bark, rough in ridges. Leaves spatulate or obovate, 1-3-lobed at the apex or some of them entire and rounded, short-petioled; cup saucer-shaped, rounded at the base, about $\frac{1}{2}$ in. wide; acorn globose-ovoid, 2-3 times as high

as the cup. Wood heavy, hard, and strong; used for fuel. Usually along streams and swamps. Del. to Ky., Mo., Fla., and Texas.

14. **Quercus marilandica** Muench. Black-Jack (Oak). Usually a small shrubby tree; bark nearly black with very rough ridges. Leaves obovate, 3-5 lobed toward the broad usually nearly truncate apex, cuneate below, the lobes short, stellate-pubescent above, brown-tomentose beneath when young, mature leaves glabrous above; cup deep, about $\frac{1}{2}$ in. broad; acorn ovoid, 2-3 times as high as the cup. In dry sterile soil. Hybridizes with *Q. phellos* and *Q. ilicifolia*. L. I. to Minn., Neb., Fla., and Texas.

Red Oaks

15. **Quercus ilicifolia** Wang. Bear Oak. A shrub or small tree, often forming thickets. Leaves mostly obovate, 2-5 in. long, short petioled, grayish-white tomentulose beneath, 3-7-lobed, lobes triangular-ovate, acute; cup saucer-shaped, $\frac{1}{4}$ - $\frac{1}{2}$ in. broad, with a turbinate or rounded base; acorn globose-ovoid, longer than the cup. In sandy or rocky soil. Me. to Pa., Del., and in mountains to N. C. and Ky.

16. **Quercus pagoda** Raf. (*Q. pagodaefolia* (Ell.) Ashe). Swamp Spanish Oak. A tree with spreading branches and dark gray, rough bark. Leaves oval or oblong, cuneate to truncate at the base, 8-12 in. long, deeply 5-11 lobed, persistently white-tomentulose beneath, lobes narrowly triangular, spreading or somewhat ascending, usually entire; cup sessile, shallow, acorn globose, about one-half enclosed in the cup. In wet or moist soil. Mass. to Fla., Ill., Mo., and Ark.

17. **Quercus rubra** L. (*Q. triloba* Mx.). Spanish Red Oak. A tree growing in dry soil. Leaves glabrous above, gray-tomentulose beneath, deeply pinnatifid into 3-7 linear or lanceolate lobes; cup saucer-shaped with a turbinate base, about $\frac{1}{2}$ in. broad; acorn subglobose and depressed, about twice as high as the cup. Wood very hard and strong; used for cooperage. An important tanbark oak. N. J. to Fla., Ohio, Mo., and Texas.

18. **Quercus velutina** Lam. Quercitron Oak. A large tree of rapid growth with very dark brown bark, rough in

ridges, and bright orange inner bark. Leaves firm, sometimes lobed to beyond the middle, brown-pubescent or sometimes stellate-pubescent when young, glabrous and shining when mature, the lobes broad, oblong or triangular-lanceolate; cup hemispheric or top-shaped, commonly narrowed into a short stalk; acorn ovoid, as long or longer than the cup. The inner bark (quercitron) yields a valuable dye; rich also in tannin. Wood hard, heavy, and strong but not tough. Sparingly self-prunes small twigs by means of basal joints. Me. to Minn., Fla., Neb., and Texas.

19. **Quercus boreàlis** Mx. f. Gray Oak. A large tree with leaves like those of *Q. maxima* and acorns like those of *Q. coccinea*. Leaves 7-13 lobed to the middle or somewhat beyond; cup turbinate, peduncled; acorn ovoid, 1-2 times as long as the cup. Quebec to Ont., N. Y., and Penn.

20. **Quercus coccínea** Wang. Scarlet Oak. A tree with pale reddish or gray inner bark. Leaves deeply pinnatifid, glabrous, bright green above, paler beneath, 4-8 in. long; cup hemispheric or top shaped, acorn ovoid, about twice as long as the cup. Autumn leaves red. In dry soil. Me. to Minn., Mo., and N. Car.

21. **Quercus ellipsoidàlis** E. J. Hill. Hill's Oak. A tall tree with a large trunk diameter and smooth, close, gray bark. Leaves broadly obovate, deeply pinnatifid, with rounded sinuses, becoming glabrous and shining; acorn small; cup top-shaped, about $\frac{1}{2}$ in. wide, covering $\frac{1}{3}$ - $\frac{1}{2}$ the ellipsoid nut. Perhaps a hybrid. In clayey soil. Ill. to Mich., Iowa, and Man.

22. **Quercus máxima** (Marsh.) Ashe. (*Q. rubra* Du Roi.) Common Red Oak. A large tree with dark gray bark, somewhat roughened. Leaves oval or somewhat obovate, 4-8 in. long, dull green above, paler beneath, lobes triangular-lanceolate, tapering from a broad base to an acuminate apex; cup saucer-shaped, its base flat or slightly convex, $\frac{1}{2}$ -1 in. broad; acorn ovoid, 2-4 times as long as the cup. Autumn leaves purplish red. Wood very coarse-grained, reddish in color, porous, and not very durable; used in carpentry, cooperage, and for clapboards. The most rapid grower of all the oaks. An important tree for tan-bark. Sprouts readily from stumps. N. S. to Ont., Minn., Fla., Kan., and Texas.

23. **Quercus schnéckii** Britt. Schneck's Oak. A very large tree with reddish-brown bark in broad ridges. Leaves obovate, shining above, paler beneath, with prominent tufts of hairs in the axils, deeply pinnatifid; acorn ovoid, cup deeply saucer-shaped. Wood hard, light red-brown. N. Car. to Ohio, Iowa., Mo., Fla., and Texas.

24. **Quercus palústris** Muench. Pin Oak. A medium-sized tree with brown bark, rough when old, the lower branches deflexed. Leaves broadly oblong or obovate, deeply pinnatifid, brighter green and shining above, duller beneath, $2\frac{1}{2}$ -5 in. long, the lobes oblong, lanceolate or triangular-lanceolate, divergent; cup saucer-shaped, $\frac{1}{4}$ - $\frac{1}{2}$ in. broad, base flat; acorn subglobose or ovoid, 2-3 times as long as the cup. Wood coarse-grained, reddish, and not durable. In moist ground. Mass., Ohio and Wis., Va., and Ark.

67. **Castànea** (Tourn.) Hill. Chestnut.

Trees or shrubs with simple alternate equilateral pinnately straight-veined serrate leaves, with a vein for each tooth, with 5-angled pith and inconspicuous medullary rays.

Flowers monecious; fruit a rounded coriaceous nut; several in a globose, mostly 4-valved involucre covered with long prickles.

1. Leaves green on both sides; large trees. *C. dentata*.

1. Leaves densely white-tomentose beneath; shrubs or small trees. *C. pumila*.

1. **Castanea dentàta** (Marsh.) Borkh. Chestnut. A large tree of very rapid growth with rough bark in longitudinal ridges. Nut sweet and edible. Wood soft, light, and coarse-grained, durable; used for cabinet-work, railway ties, posts, cooperage, "acid wood," and telegraph poles. Sprouts freely from stumps. In rich gravelly or sandy soil. Me. to Mich., Ga., and Ark.

2. **Castanea pùmila** (L.) Mill. Chinquapin. A shrub or small tree. Nut very sweet. Wood much like in *C. dentata* but heavier. In dry soil. N. J. to Ind., Mo., Fla., and Texas.

68. **Fagus** (Tourn.) L. Beech.

Large trees with alternate 2-ranked simple equilateral pinnately straight-veined dentate leaves, with a vein for each tooth, and with prominent green medullary rays.

Winter buds usually very long-pointed; flowers monocious; nut 3-angled, enclosed in a 4-valved bur with soft, short prickles.

1. **Fagus grandifolia** Ehrh. American Beech. A large tree, the lower branches spreading. Autumn leaves pure yellow. Nut sweet and edible. Wood hard, heavy, light-colored, rather close-grained, not durable in the ground; used for making chairs, handles, plane-stocks, shoe-lasts, in turnery, and for "acid wood." In rich but not necessarily deep soil. N. S. to Ont. and Minn., Mo., Fla., and Texas.

Betulaceae. Birch Family.69. **Carpinus** (Tourn.) L. Blue-beech.

Small trees with alternate, 2-ranked, simple, straight-veined, equilateral, serrate leaves; with peculiar fluted or projecting ridges on the trunks and larger branches; and with dark, smooth bark.

Flowers in aments; monocious; nuts small in the large-bracted fruiting ament; bracts leaf-like.

1. **Carpinus caroliniana** Walt. Blue-beech. A small tree with slender terete gray twigs. Wood light brown, very compact, strong, and heavy, not durable in the ground; used for turnery, tool handles, etc. The charcoal is used for making powder. In moist soil and along streams. N. S. to Minn., Fla., Kan., and Texas.

70. **Ostrya** (Micheli) Scop. Hop-hornbeam.

Small trees with alternate, 2-ranked, simple, straight-veined, equilateral, serrate leaves; with glandular pubescent young twigs and fine-furrowed scaly bark.

Flowers in aments; monocious; nuts small, in a hop-like fruiting ament.

1. **Ostrya virginiana** (Mill.) K. Koch. Hop-hornbeam. A small tree with scaly bark. Wood white, compact, very hard

and strong. In dry or moist soil. Cape Breton I. to Man., Fla., Neb., Kan., and Texas.

71. **Bétula** (Tourn.) L. Birch.

Trees or shrubs with simple, serrate, 2-ranked leaves; with small samara-like nuts in a cone-like ament, and frequently with papery or leathery bark.

Usually aromatic, monocious, styles 2, ovulary bilocular.

1. Leaves usually cordate or rounded at the base, sharply serrate, only slightly doubly serrate; bark brown or yellowish, close or separating into layers; bark of twigs with wintergreen flavor; fruiting aments sessile or nearly so. 2.
1. Leaves acute, obtuse, or truncate at the base, rarely cordate, prominently doubly serrate or serrate-dentate; bark chalky white or greenish brown; bark of twigs not with the flavor of wintergreen, usually bitter; fruiting aments peduncled. 3.
2. Bark not separating in layers, becoming furrowed; leaves shining above; fruiting bracts glabrous or pubescent, less than $\frac{1}{4}$ in. long, lobed at the apex. *B. lenta*.
2. Bark separating in papery layers when old, somewhat silvery; leaves dull above; fruiting bracts ciliate, more than $\frac{1}{4}$ in. long, lobed to about the middle. *B. lutea*.
3. Bark greenish or reddish brown, peeling in papery layers especially above; leaves rhombic, acute at both ends; young leaves, twigs and aments tomentose; fruiting aments oblong, erect. *B. nigra*.
3. Bark of trunk and larger branches chalky white, usually peeling off in thin layers; fruiting aments cylindrical, pendant or spreading. 4.
4. Leaves deltoid, very long acuminate at the apex; bark not readily separable into thin layers; twigs with numerous resinous glands. *B. populifolia*.
4. Leaves acute or acuminate, usually ovate, in some cultivated forms of various shapes; bark peeling off in thin layers. 5.

5. Leaves ovate or suborbicular; native; occasionally cultivated. *B. papyrifera*.

5. Leaves various, commonly triangular or rhombic-ovate, on slender petioles; twigs often pendulous or weeping; much cultivated, from Europe and Asia. *B. alba*.

1. **Betula lénta** L. Sweet Birch. A large tree with dark brown, close, smooth bark, becoming furrowed and not separating in layers. Wood hard, fine-grained, of a reddish tint; used for cabinet-work. N. Eng. to Ont., Fla., and Tenn.

2. **Betula lùtea** Mx. f. Yellow Birch. A large tree with yellowish or gray bark, separating in thin layers or close. Autumn leaves pure yellow. Wood hard and close-grained; used in making furniture, wheel-hubs, pill-boxes, etc. Newf. to Man., N. Car., Ga., and Tenn.

3. **Betula nìgra** L. River Birch. A slender tree with reddish or greenish-brown bark peeling off in very thin layers. Branches long and slender, arched and heavily drooping. Wood rather light, hard, strong and close grained; used for furniture and turnery. "Birch brooms" are made from the twigs. Along streams. Mass. and N. H. to Iowa, Minn., Kan., Fla., and Texas.

4. **Betula papyrífera** Marsh. Paper Birch. A large tree with chalky white bark separating in thin layers. The bark is very water-proof and is used for making canoes by Indians and trappers. Wood rather heavy, hard, and very close-grained; decays rapidly when exposed; used for making spools, pegs, shoe-lasts, wooden shoes, wagon hubs, ox-yokes, wood-carving, wood pulp, and in wood turnery. Newf. to Alaska, Penn., Mich., Neb., and Wash.

5. *Betula álba* L. European White Birch. A tree with chalky-white bark, much cultivated for ornament, especially the "weeping" and cut-leaved varieties.

6. **Betula populifòlia** Marsh. American White Birch. A slender, short-lived tree with smooth white bark, tardily separating in thin sheets. Autumn leaves pure yellow. Wood soft, white, not durable; used for making spools, shoe-pegs, etc. Leaves tremulous like those of the aspens. In moist or dry soil. N. S. to Ont., Penn., and Del.

72. **Alnus** (Tourn.) Hill. Alder.

Trees or shrubs with 3-angled pith, alternate straight-veined, simple leaves and stalked winter buds.

Monecious; nuts small, compressed, in woody cone-like aments which are persistent throughout the year.

1. Leaves obovate, broadly oval or suborbicular, dull; catkins expanding long before the leaves. 2.

1. Leaves oblong, shining above, catkins expanding in autumn. *A. maritima*.

2. Leaves finely tomentose or glaucous beneath. *A. incana*.

2. Leaves green, glabrous or sparingly pubescent beneath. 3.

3. Leaves finely serrulate, foliage not glutinous. *A. rugosa*.

3. Leaves dentate-serrate; twigs glutinous. *A. vulgaris*.

1. **Alnus incana** (L.) Moench. Hoary Alder. A shrub or small tree with the young shoots pubescent. Wood soft, light brown. In wet soil. Newf. to Sask., N. Y., Penn., Ohio, and Neb. Also in Europe and Asia.

2. **Alnus rugosa** (DuRoi) Spreng. Smooth Alder. A shrub or small tree with smooth bark, the young shoots somewhat pubescent. Wood soft, light brown. In wet soil or on hillsides. Me. to Ohio, Minn., Fla., and Texas.

3. **Alnus vulgaris** Hill. European Alder. A tree of rapid growth, developing readily in ordinary dry soil. Usually in wet places. Wood soft, brown. Native of Europe. Newf., and N. J. to Ill.

4. **Alnus maritima** (Marsh.) Muhl. Seaside Alder. A small tree, glabrous or nearly so. Wood soft, light brown. In wet soil. Del. and Md.; also in Okla.

Juglandaceae. Walnut Family.73. **Carya** Nutt. Hickory. (*Hicoria* Raf.)

Large trees with alternate serrate odd-pinnate leaves, terminal buds, 5-angled solid pith, and numerous bundle scars scattered or in 3 areas.

Monecous; axillary buds superposed; staminate flowers in slender aments; fruit a nut in a husk.

1. Terminal bud-scales valvate, 4-6; leaflets 7-15, lanceolate or oblong-lanceolate, more or less falcate. 2.
1. Terminal bud-scales imbricate, more than 6; leaflets 3-9, not falcate, the uppermost larger and generally obovate. 4.
2. Nut elongated, almost terete, seed sweet; leaflets 11-15, inequilateral, acuminate. *C. pecan.*
2. Nut somewhat compressed or angled, usually as broad as long; seed intensely bitter; lateral leaflets falcate. 3.
3. Leaflets 7-11; nut smooth; husk thin, splitting to below the middle. *C. cordiformis.*
3. Leaflets 9-13; nut angled, husk thin, splitting to the base. *C. aquatica.*
4. Terminal bud large, $\frac{1}{2}$ -1 in. long; husk splitting freely to the base, nut angled, seed sweet; middle lobe of the staminate calyx narrow, often at least twice as long as the lateral ones. 5.
4. Terminal bud small, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; husk comparatively thin, not splitting freely to the base, nut not strongly angled, usually nearly smooth; lobes of the staminate calyx mostly nearly equal. 8.
5. Bark shaggy, separating in long plates; husk very thick, splitting to the base; outer bud-scales persisting through the winter. 6.
5. Bark close, rough; leaflets 7-9, stellate pubescent; outer bud scales falling away in autumn; husk not separating quite to the base; twigs and petioles tomentose. *C. alba.*
6. Leaflets 3-5, rarely 7, nut rounded at the base, $\frac{1}{2}$ -1 in. long. 7.
6. Leaflets 7-9; nut usually pointed at both ends, 1-1 $\frac{1}{4}$ in. long. *C. laciniosa.*
7. Leaflets oblong-lanceolate to obovate; twigs puberulent. *C. ovata.*
7. Leaflets narrowly lanceolate; twigs glaucous. *C. carolinæ-septentrionalis.*
8. Twigs and leaves pubescent, at least until late in the season; leaflets 5-9, usually 7. 9.

8. Twigs and leaves soon becoming glabrous or nearly so. 10.
9. Bark very rough, broken into squares; leaflets covered beneath with silvery peltate glands mixed with resin globules; petioles brownish hairy, becoming glabrate; fruit subglobose to pear-shaped. *C. villosa*.
9. Bark deeply furrowed; leaflets pubescent on the veins beneath, the petioles rusty pubescent; fruit ellipsoid to slightly obovoid, very aromatic. *C. buckleyi*.
10. Leaflets 3-7, usually 5; bark not shaggy; fruit tapering at the base, usually smooth. *C. glabra*.
10. Leaflets 5-7, usually 7; bark becoming shaggy, at least on old trunks; fruit rounded at the base. 11.
11. Leaves glabrous thruout; fruit subglobose, densely scaly. *C. microcarpa*.
11. Leaves becoming glabrous, often scurfy-pubescent when young; fruit oval, granular with yellow scales. *C. ovalis*.

1. **Carya pecán.** (Marsh.) Schneid. Pecan (Hickory.) A large tree of rapid growth with rough bark and a long tap root. Leaflets 11-15, oblong-lanceolate, short-stalked, inequilateral, acuminate; fruit oblong-cylindric; husk thin, 4-valved; nut smooth, oblong, thin-shelled, pointed, seed delicious and important commercially; wood hard, brittle, light brown. Along streams and in moist soil. Ind. to Iowa and Kan., south to Ala. and Texas.

2. **Carya cordifórmis** (Wang.) K. Koch. Bitternut (Hickory). A slender tree with close rough bark. Leaflets 7-11, sessile, long-acuminate, the lateral ones falcate; fruit subglobose, narrowly 6-ridged; husk thin tardily and irregularly 4-valved; nut short-pointed, thin-shelled. Wood heavy, strong, and tough. In moist woods and swamps. Quebec to Minn., Fla., and Texas.

3. **Carya aquática** (Mx. f.) Nutt. Water Hickory. A tree with close bark, living in swamps. Leaflets 9-13, lanceolate, or the terminal one oblong, long acuminate at the apex, narrowed at the base, the lateral ones falcate; fruit oblong, ridged, pointed; husk thin, tardily splitting; nut oblong, thin-shelled, angular. Wood of poorer quality than that of other hickories. Va. to Fla., Ill., Ark., and Texas.

4. **Carya microcarpa** Nutt. Small-fruited Hickory. A tree having the older bark separating in narrow plates. Leaflets 5-7, oblong, or ovate-lanceolate, acuminate at the apex; fruit globose or globose-oblong; husk thin, tardily and incompletely splitting to the base; nut subglobose, slightly compressed, thin-shelled, pointed; seed sweet. Wood hard, strong and tough. In rich soil. Mass. to Ohio and Mich., Va., Ga., Ill., and Mo.

5. **Carya glabra** (Mill.) Spach. Pignut (Hickory). A tree with close rough bark. Leaflets 3-7, rarely 9, oblong, oblong-lanceolate or the upper obovate, sessile, acuminate at the apex, usually narrowed at the base; fruit obovoid or obovoid-oblong; husk thin, the valves very tardily dehiscent; nut brown, angled, pointed, very thick-shelled; seed bitter and astringent, not edible. Wood hard, strong, tough, and rather dark brown. In dry or moist soil. Me. to Ont., Minn., Kan., Tex., and Fla.

6. **Carya ovàlis** (Wang.) Sarg. Oval Pignut (Hickory). A medium-sized tree usually with tight bark below and more or less scaly above and with reddish-brown twigs, usually becoming smooth. Leaflets 3-7, often 7, usually pubescent beneath in the axils of the veins, sometimes the veins also pubescent; fruit variable in size and shape, usually small, commonly obovoid to subglobose, granular with yellow scales somewhat aromatic, husk usually tardily splitting to the base; nut elliptic to obovoid, seed sweet. Wood as in *C. ovata* and with the same uses. N. Y. to Ga., Miss., Ill., and Ark.

7. **Carya búckleyi** Dur. Buckley's Hickory. A medium-sized tree with tight, deeply furrowed bark and reddish-brown, more or less pubescent, mature twigs. Leaflets 5-7, prevailing 7; fruit ellipsoid to slightly obovoid, very aromatic, husk splitting to below the middle; nut oblong, rounded at each end, shell thick, seed sweet. Wood as in *C. alba* and *C. ovata*. Ind. to La. and Tex.

8. **Carya villòsa** (Sarg.) Schneid. Scurfy Hickory. A small or medium-sized tree with deeply furrowed, dark gray bark. Leaflets 5-9, thickly covered beneath with silvery pel-tate glands, mixed with resinous globules, generally pubescent; fruit obovoid, the husk partly splitting; nut brown, thick-

shelled, angled; seed small, sweet. Wood hard and dark brown. Del. to Fla. and Mo.

9. **Carya álba** (L.) K. Koch. Mockernut (Hickory). (*C. tomentosa* (Lam.) Nutt.). A large tree with close rough bark. Leaflets 7-9, oblong-lanceolate or the upper oblanceolate or obovate, long-acuminate; fruit globose or oblong-globose; husk thick; nut grayish-white, angled, pointed at the summit, little compressed, thick-shelled; kernel small but sweet and edible. Wood much like in *C. ovata*, very hard and tough, dark brown. In rich soil. Mass. to Ont., Neb., Fla., and Texas.

10. **Carya laciniòsa** (Mx. f.) Loud. Shellbark (Hickory). A large tree with the bark separating in long narrow plats and with a long tap root. Leaflets 7-9, rarely 5, acute or acuminate, sometimes 8 in. long; fruit oblong; husk thick, soon splitting to the base; nut oblong, somewhat compressed, thick-shelled, pointed at both ends, yellowish-white; seed sweet and edible. Wood like in *C. ovata*, strong and tough. In rich soil. N. Y. and Ohio, to Iowa, Kan., Okla., and Tenn.

11. **Carya carolinae-septentrionalis** (Ashe.) Engel. & Grabn. Southern Shagbark. (Hickory). A tree with gray bark hanging in loose strips. Leaflets 3-5, glabrous, ciliate; fruit subglobose; husk soon falling into four pieces; nut white or brownish, much compressed, angled, cordate or subcordate at the top, thin-shelled. In sandy or rocky soil. Del. to Ga. and Tenn.

12. **Carya ovàta** (Mill.) K. Koch. Shagbark (Hickory.) A large tree with shaggy bark in narrow plates. Leaflets 5, sometimes 7, oblong, oblong-lanceolate, or the upper obovate, acuminate at the apex, narrowed to the sessile base; fruit subglobose; husk thick, soon splitting; nut white, somewhat compressed, pointed, slightly angled, thin-shelled. Seed finely flavored, most "hickory nuts" of the markets being from this species. Wood very heavy, hard, tough and elastic; used for agricultural implements, carriages, wagon stock, ax handles, cooperage, sucker rods, wheel spokes, etc. Also a fine fuel wood. Not durable in the ground. In rich soil. Quebec to Minn., Fla., Kan., and Texas.

74. *Juglans* L. Walnut.

Large trees with alternate odd-pinnately compound leaves and diaphragmed pith.

Monecious; axillary buds superposed; staminate flowers in slender catkins; fruit a nut in a fleshy husk; seed edible.

1. Leaflets almost entire; nut rather smooth and thin-shelled; twigs glabrous. *J. regia*.
1. Leaflets serrate; nut rough, thick-shelled. 2.
2. Petioles smoothish or puberulent; axil of leaf without a hairy cushion below the buds; bark brown or black, rough; fruit globose, not viscid. *J. nigra*.
2. Petioles pubescent, sticky or gummy when young; axil of the leaf with a hairy cushion below the buds; bark gray, the ridges smooth on the surface; fruit oblong, viscid. *J. cinerea*.

1. *Juglans regia* L. English Walnut. A round-headed tree with leaflets almost entire and nearly glabrous. Husk of the nut friable. Cultivated for the sweet nuts; from Asia.

2. *Juglans nigra* L. Black Walnut. A large tree with a trunk up to 24 feet in circumference and with rough brownish black bark and a long tap root. Wood heavy, hard, strong, of coarse texture; heart-wood dark brown, of great value; used for cabinet-work, interior finish, gun-stocks, turnery, and as veneer. Common on flood plains of streams. Mass. to Ont. and Minn., south to Kan., Tex., and Fla.

3. *Juglans cinerea* L. Butternut. A large tree with gray bark, the outer surface of the ridges smooth. Heart-wood lighter colored and softer than in *J. nigra*; used for ornamental cabinet-work, interior finish and cooperage. In rich or rocky woods. N. B. to N. Dak., Kan., Del., Ga., Ark., and Miss.

Myricaceae. Bayberry Family.75. *Myrica* L. Bayberry.

Shrubs or small trees with alternate simple peltate-scaly or resin-dotted leaves; with cylindrical pith, 3 bundle scars and glandular-dotted twigs.

Mostly diecious; flowers in catkins; drupe globose or ovoid; its exocarp waxy.

1. **Myrica cerifera** L. Wax-myrtle. A slender diecious tree with gray, nearly smooth bark. Leaves persistent through the winter. Wood light, brown in color. In sandy swamps or wet woods. Penn. and N. J. to Md., Fla., and Texas, north to Ark.

Order, SALICALES.

Salicaceae. Willow Family.

76. **Pópulus** L. Poplar.

Large trees with alternate simple leaves, not 2-ranked and not entire but with gland-tipped teeth; with 5-angled pith, 3 bundle scars, and terminal, more or less resinous buds with several bud scales.

Diecious; flowers in aments; fruit a capsule; seeds with long cottony hairs; leaves mostly with 2 or more glands at or near the base of the blade; twigs prominently self-pruned by means of cleavage planes in basal joints.

1. Leaves and twigs persistently and densely white tomentose below, usually lobed; self-pruning scars very prominent on the small twigs. *P. alba*.
1. Leaves and twigs glabrous or nearly so when old, not lobed. 2.
2. Petioles terete or channeled, not much flattened laterally; leaves crenate. 3.
2. Petioles strongly flattened laterally. 4.
3. Leaves densely tomentose when young, often with 2 small lobes at the base; capsule slender-pedicelled. *P. heterophylla*.
3. Leaves not tomentose but usually somewhat pubescent; capsule short-pedicelled. *P. tacamahacca*.
4. Leaves broadly deltoid, abruptly acuminate; terminal winter buds usually angular. 5.
4. Leaves broadly ovate or suborbicular; terminal winter buds rounded or only slightly angular. 7.
5. Trees of tall, narrow growth with strongly erect branches, giving a spire-like appearance, young twigs glabrous; leaves usually wider than long, more or less acute at the base. *P. italica*.
5. Trees with spreading branches. 6.

6. Young leaves pubescent; capsules nearly sessile. *P. nigra*.
6. Young leaves not pubescent, shining; capsules slender-pedicelled. *P. balsamifera*.
7. Leaves coarsely sinuate-dentate, densely white-tomentose when young, glabrous when mature. *P. grandidentata*.
7. Leaves crenulate-dentate, glabrous except the ciliate margins. *P. tremuloides*.

1. **Populus álba** L. White Poplar. A large tree with smooth, light, greenish-gray bark often with black diamond-shaped scars; sprouting freely from the roots and hence not desirable for yards. Young foilage densely white-tomentose, the leaves becoming glabrate and dark green above, broadly ovate or nearly orbicular in outline, 3-5 lobed, or irregularly dentate, 2-4 in. long. Wood soft and nearly white. Native of Europe and Asia. N. B. to Ont., Va., and Ohio.

2. **Populus heterophýlla** L. Swamp Poplar. An irregularly branching tree with rough bark. Leaves long-petioled, broadly ovate, crenulate-denticulate, 5-6 in. long. Wood soft, compact, weak, brown in color. In swamps. Conn. to Ga., west to La. and northward to Mo., Ind., and Ohio.

3. **Populus tacamahacca** Mill. Tacamahac Poplar. A large tree with nearly smooth gray bark. Leaves broadly ovate, dark green and shining above, pale beneath, rounded or acute at the base, crenulate, 3-5 in. long. Wood very light and soft, weak, brown. In moist or dry soil, commonly along streams and lakes. The subspecies **P. cándicans** Ait. Balm-of-Gilead, has the leaves broadly ovate, truncate or cordate at the base, and the petioles and nerves usually puberulent. Mostly escaped from cultivation. Newf. to Alaska, south to Va., Ohio, S. Dak., and Ore.

4. **Populus balsamífera** L. (*P. deltoides* Marsh). Cottonwood. A large tree of very rapid growth, with rough, deeply furrowed, brown bark when old. Bark of young trees grayish-green and rather smooth. The giant of the poplars. Petiole much flattened laterally, causing the leaves to rustle in the wind. Leaves glabrous, broadly deltoid-ovate, abruptly acuminate at the apex, crenulate, truncate at the base, 4-7 in.

long. Wood light and soft and very durable if kept in the dry; used for building lumber, light boxes, paper pulp, sugar and flour barrels, cracker boxes, crates and wooden ware; also a good fuel wood. A most useful and ornamental tree of very rapid growth if planted in ravines and low places. In cities only staminate trees should be planted. In favorable soil often attaining a trunk diameter of $3\frac{1}{2}$ feet in forty years. In moist soil, especially on the banks and flood plains of creeks and rivers. Quebec to Man., south to Fla., Kan., and N. Mex.

5. ***Populus nigra*** L. Black Poplar. A large tree with terete twigs. Mature leaves firm, broadly deltoid, abruptly acuminate at the apex, broadly cuneate or obtuse at the base, crenate, 2-4 in. long. Naturalized from Europe. N. Y. and southward along the Delaware River.

6. ***Populus italica*** Moench. Lombardy Poplar. A spire-like tree of rapid growth. Commonly planted for ornament.

7. ***Populus grandidentata*** Mx. Largetooth Aspen. A tree with smooth, greenish-gray bark. Leaves tomentose when young, glabrous when mature, short-acuminate, obtuse or truncate at the base, 2-4 in. long. Wood soft and white; used for paper pulp. In rich moist soil. N. S. to Ont. and Minn., south to N. J. and Ohio, and in the Alleghanies to Tenn.

8. ***Populus tremuloides*** Mx. American Aspen. A slender tree with light green, smooth bark. Leaves usually short-acuminate at the apex, finely crenulate, truncate, rounded or subcordate at the base, 1-3 in. broad. Petioles very slender, causing the leaves to quiver and rustle in the slightest breeze. Wood white and soft; used for making coarse paper. In moist or dry soil. Newf. to Alaska, south to N. J., Ohio, Ky., and Neb.; in the Rocky Mts. to Mexico and to Lower Cal.

77. ***Salix*** (Tourn.) L. Willow.

Shrubs or trees with alternate simple serrate pinnately veined leaves and axillary buds with a single outer scale.

Diecious; flowers in aments; fruit a capsule, the seeds with long cottony hairs; leaves sometimes with glands on the petiole or at the base of the blade and with gland-tipped teeth. Twigs self-pruned by means of basal brittle zones.

The charcoal from the larger species used for making gunpowder.

1. Twigs decidedly pendulous or "weeping," green or yellowish-green; leaves linear-lanceolate, acuminate, serrulate, smooth, rather pale beneath, petioles glandular above; capsule glabrous, pedicel very short, stigma sessile. *S. babylonica*.
1. Twigs not pendulous nor weeping, but some may be drooping. 2.
2. Leaves tapering to the short petioled or nearly sessile base, linear-lanceolate, remotely denticulate, coarsely silky when young, usually glabrate in age; shrubs or small trees with a narrow, slender crown; capsule glabrous or silky. Stamens 2. *S. interior*.
2. Petioles present and rather prominent and slender except in some individuals. 3.
3. Leaves silky, tomentose, or hairy below when mature; stamens 3. 4.
3. Leaves glabrous below, or nearly so, when mature, sometimes finely pubescent when young. 5.
4. Leaves long linear-lanceolate, sparingly repand-crenulate, or entire, white or silvery silky beneath, without glands on the petiole, acuminate; twigs terete, green; capsule nearly sessile, silky or tomentose, style long. *S. ziminalis*.
4. Leaves lanceolate, narrowed at the base, serrulate, silky pubescent and glaucous beneath, usually with glands on the petiole at the base of the blade; capsule glabrous, pedicel very short, stigma sessile. *S. alba*.
4. Leaves ovate-lanceolate, slender-pointed, firm, pubescent or white-tomentose beneath, sharply serrate or entire; bracts yellow, linear-oblong or lanceolate; capsule silky or tomentose, pedicel filiform. *S. bebbiana*.
5. Petioles usually without glands, or if with glands then the leaves of the ovate type and short pointed; stamens 2. 6.
5. Petioles usually with glands on the top or at the base of the blade; stamens 3-12, in one species 2; capsule glabrous. 8.

6. Length of leaf-blade less than 3 times its breadth; mature leaves thin and dull, elliptic, ovate-oval, or obovate, acute or obtuse at the apex; stamens 2. *S. pyrifolia*.
6. Length of leaf-blade 3 times its breadth or more. 7.
7. Leaves oblanceolate or spatulate, acute, serrulate, somewhat glaucous beneath; twigs purplish, flexible, filaments of stamens united; capsule silky or tomentose, sessile; stigma sessile. *S. purpurea*.
7. Leaves lanceolate or oblanceolate, acuminate, finely serrate with minute gland-tipped teeth, pale and glaucous beneath; twigs of the season pubescent or puberulent; capsule glabrous. *S. cordata*.
7. Leaves obovate, oblong or oblanceolate, rather thin, acute at both ends; irregularly or indistinctly toothed, glaucous and nearly white beneath; bracts fuscous, obovate or cuneate, long-hairy; capsule silky or tomentose, stalked. *S. discolor*.
8. Petioles short; leaves narrowly lanceolate, usually falcate, narrowed at the base, glabrous or slightly pubescent, green on both sides or slightly paler beneath. *S. nigra*.
8. Petioles rather prominent and slender except in some individuals; leaves lanceolate or broader. 9.
9. Leaves dark-green above, glaucous or whitish beneath, not coriaceous. 10.
9. Leaves yellow-green and glossy on both sides, thick, normally ovate, very long acuminate with a slender tip; catkins thick and dense, stamens mostly 3, flower bracts dentate; capsule large, short-pedicelled; twigs brown, polished. *S. lucida*.
10. Leaves ovate-lanceolate, broadest below the middle, acuminate, petioles often red; stamens 5-12; capsule narrow-conic, pedicel slender, 3-5 times as long as the gland; bark rough, brown. *S. amygdaloides*.
10. Leaves lanceolate, long-acute; stamens 2, capsules very narrow-conic, pedicel short, about twice as long as the gland; bark gray. *S. fragilis*.
10. Leaves lanceolate or oblong-lanceolate, rounded, subcordate, or narrowed at the base, 3-8 in. long; very

white and somewhat pubescent beneath; capsule conic, pedicel slender, 3-5 times as long as the gland; bark dark reddish-brown with small scales. *S. wardi*.

1. ***Salix amygdaloides*** And. Peachleaf Willow. A tree with rough, brown, scaly bark. Leaves pubescent when young, glabrous when old, dark green above, pale and slightly glaucous beneath, narrowed at the base, 3-5 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide; capsule narrowly ovoid, acute, glabrous, finally about as long as the filiform pedicel. Along streams, lakes and ponds. Quebec to Br. Col., N. Y., Ohio, Mo., and N. Mex.

2. ***Salix nigra*** Marsh. Black Willow. A medium-sized tree with a rough, flaky, dark brown bark. Leaves narrowed at the base, serrulate, 2-5 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide, or wider; capsule ovoid, acute, about as long as its pedicel. Along streams and lakes. The subspecies *S. nigra falcata* (Pursh.) Torr. has narrower more falcate leaves. Hybridizes with *S. alba*. N. B. to Ont., Fla., Cal. and Kan.

3. ***Salix wardi*** Bebb. Ward Willow. A tree with spreading or drooping branches and dark reddish-brown bark. Leaves lanceolate or oblong-lanceolate, rounded, subcordate, or narrowed at the base, 2-7 in. long, $\frac{1}{2}$ - $1\frac{1}{2}$ in. wide, somewhat pubescent beneath; capsule conic. Wood dark brown. Along streams and lakes. Md. to Kan., south to Fla. and Ark.

4. ***Salix lucida*** Muhl. Shining Willow. A tall shrub or small tree with smooth or slightly scaly bark, the twigs yellowish brown and shining. Leaves lanceolate, ovate-lanceolate, or ovate, mostly long-acuminate, narrowed or rounded at the base, sharply serrulate, green and glossy on both sides or with a few scattered hairs when young, 3-5 in. long, $\frac{3}{4}$ - $2\frac{1}{2}$ in. wide; capsule narrowly ovoid, acute, glabrous, much longer than its pedicel. A very beautiful willow in swamps and along streams and lakes. Newf. to N. W. Ter., N. J., Ohio, Ky., and Neb.

5. ***Salix fragilis*** L. Crack Willow. A tall slender tree with roughish, gray bark and green branches. Leaves lanceolate, long-acuminate, narrowed at the base, sharply serrulated, glabrous on both sides, rather dark green above, paler beneath, 3-6 in. long, $\frac{1}{2}$ -1 in. wide; capsule long-conic. Twigs

used for basket work. Native of Europe. Hybridizes with *S. alba*. Mass. to N. J., Ky., and Ohio.

6. ***Salix interior*** Row. Sandbar Willow. A shrub or small slender tree usually forming thickets. Flowers can be found for a long time. Leaves linear-lanceolate, acuminate, remotely denticulate with somewhat spreading teeth, short-petioled; $2\frac{1}{2}$ -4 in. long; capsule ovoid-conic, finely silky when young, glabrate in age. Along streams and ponds and in ravines, sometimes on high ground. Quebec to N. W. Ter., south to Va. and Texas.

7. ***Salix álba*** L. White Willow. A large tree with rough gray bark. Leaves lanceolate, narrowed at the base, serrulate, silky-pubescent on both sides when young, less so and pale and glabrous beneath when mature, 2-5 in. long, $\frac{1}{2}$ -1 in. wide; capsule ovoid, acute. In moist soil. Native of Europe. The subspecies *S. alba vitellina* (L.) Koch., has the mature leaves glabrous and the twigs yellowish-green. N. S. and Ont. to N. C. and Iowa.

8. ***Salix babylónica*** L. Weeping Willow. A large graceful tree with weeping branches, often planted in yards and cemeteries. Leaves linear-lanceolate, serrulate, narrowed at the base, glabrous when mature, green above, paler beneath, 3-6 in. long, $\frac{1}{2}$ -1 in. wide; capsule ovoid-conic. Native of Asia. Conn. to Va. and Mich.

9. ***Salix pyrifolia*** And. Balsam Willow. Usually a shrub but sometimes arborescent with a slender erect stem. Leaves elliptic, ovate-oval, or obovate, thin, glabrous, acute at the apex, rounded or subcordate at the base, glaucous beneath, 2-3 in. long, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. wide, slightly crenulate-serrulate; capsule very narrow, acute. In swamps. Newf. to B. C., south to Me., Mich., and Minn.

10. ***Salix cordata*** Muhl. Heartleaf Willow. A tree or shrub with small, appressed scales on the thin bark. Leaves lanceolate, or oblanceolate, acuminate, finely serrate with minute gland-tipped teeth, rounded or narrowed at the base, glabrous or nearly so when mature, pale beneath, $2\frac{1}{2}$ -5 in. long, $\frac{1}{2}$ -1 in. wide; capsule ovoid. Wood dark brown. On river banks and in moist places. N. B. to B. C., Va., Mo., Col., and Cal.

11. *Salix viminalis* L. Osier Willow. A small slender tree or shrub with green twigs. Leaves long linear-lanceolate, sparingly, repand-crenulate or entire, revolute-margined, short-petioled, glabrous above, silvery-silky beneath, 3-6 in. long; capsule narrowly ovoid-conic, acute. Cultivated for wickerware. Native of Europe and Asia. Newf. to Penn.

12. *Salix bebbiana* Sarg. Bebb Willow. A shrub or small tree. Leaves elliptic, oblong, or oblong-lanceolate, sparingly serrate or entire, dull green and puberulent above, pale and tomentose beneath, nearly glabrous when very old; capsule very narrowly long-conic, twice as long as the filiform pedicel. In dry soil along streams. Newf. to Alaska, N. J., Ohio, Neb., and Utah.

13. *Salix discolor* Muhl. Pussy Willow. A shrub or low tree in swamps or moist hillsides. Leaves obovate, oblong or oblanceolate, usually glabrous, glaucous and nearly white beneath, irregularly serrulate or nearly entire, slender-petioled, 1½-4 in. long; capsule narrowly conic, tapering to a slender beak. N. S. to Sask., Del., and Mo.

14. *Salix purpurea* L. Purple Willow. A slender shrub or small tree with smooth and very bitter bark, the branches often trailing. Leaves oblanceolate or spatulate, acute, serrulate, narrowed at the base, short-petioled, glabrous above, paler and somewhat glaucous beneath, 1½-2½ in. long; capsule ovoid-conic, obtuse, tomentose. Cultivated for wickerware. Native of Europe. Escaped from Ont. and Ohio eastward.

Subclass, INFERRAE.

Order, UMBELLALES.

Araliaceae. Ginseng Family.

78. *Aralia* L. *Aralia*.

Our species small trees with alternate, bipinnate, decom-pound, prickly leaves; with prickly twigs; and with about 20 bundle scars in the leaf scar.

Flowers pentamerous tetracyclic, epigynous, in panded umbels; fruit a small berry.

1. *Aralia spinosa* L. Angelica-tree. A prickly shrub or small tree with long-petioled bipinnate leaves. In low

ground and along streams. Sometimes cultivated. Conn. to Fla., Ohio, Mo., and Texas.

Cornaceae. Dogwood Family.

79. *Nýssa* L. Tupelo.

Trees with alternate leaves, not 2-ranked; with 3 vascular bundles in the base of the petiole and with solid diphragmed pith.

Flowers small, greenish, imperfectly diecious in capitate clusters or short racemes; sometimes solitary; fruit a drupe, the stone usually ridged.

1. Leaves mostly entire; carpellate flowers 2-14 in a cluster. 2.
1. Leaves usually dentate; carpellate flowers solitary. *N. aquatica*.
2. Leaves mostly acute or acuminate; carpellate flowers 2-14 together; stone little flattened. *N. sylvatica*.
2. Leaves mostly obtuse; carpellate flowers 2-3 together, stone much flattened. *N. biflora*.

1. *Nyssa sylvática* Marsh. Common Tupelo. A large tree with horizontal branches and with rough bark. Leaves bright crimson, scarlet, or purple in autumn. Wood firm, heavy, strong, tough, close-grained, and hard to split; used for hubs of wheels, pulleys, handles, wooden shoes, woodenware, etc. Not durable if exposed. In rich moist soil. Not easily transplanted. Me. and Ont. to Fla., Mich., Mo., and Texas.

2. *Nyssa biflora* Walt. Southern Tupelo. A small tree similar to the preceding, the base swollen. In swamps and along ponds. N. J. to Va., Fla., and La.

3. *Nyssa aquática* L. Water Tupelo. A large tree with slender-petioled, oval or ovate, acute or acuminate leaves, usually angular dentate. Wood soft, tough, light brown, or nearly white. In swamps. Va. to Ill. and Mo., south to Fla. and Texas.

80. *Córnus* (Tourn.) L. Dogwood.

Shrubs or small trees with opposite or rarely alternate, entire pinnately veined leaves having the upper two veins curv-

ing toward the tip and more or less parallel with the midrib; and with distinct, exposed, axillary buds.

Flowers in panicles; fruit a bilocular white or blue drupe; cymes self-pruned when the fruit is ripe.

1. Leaves alternate; twigs green, smooth; flowers in cymose panicles, drupe blue. *C. alternifolia*.

1. Leaves opposite, ovate or ovate-lanceolate; drupe globose, white. *C. asperifolia*.

1. **Cornus alternifolia** L. f. Blue Dogwood. A shrub or small tree with smooth, greenish, bitter bark. Wood hard, reddish brown. In rich soil. N. S. to Ga., Ont., Minn., W. Va., Ala., and Mo.

2. **Cornus asperifolia** Mx. Rough-leaf Dogwood. A tall shrub, sometimes tree-like, with reddish brown twigs. In rich or moist ground and flood plains. Ont. to Fla., Minn., Kan., and Texas.

81. **Cynóxylon** Raf. Dogwood.

Trees or shrubs with opposite, entire, pinnately veined leaves having the* upper two veins curving toward the tip and more or less parallel with the midrib; and with minute axillary buds hidden under the petiole bases.

Flowers in heads subtended by an involucre of 4 large whitish bracts; fruit a bilocular, red drupe.

1. **Cynoxylon flóridum** (L.) Raf. Flowering Dogwood. A small very ornamental tree, with rough reticulate bark. Leaves bright red in autumn. Wood solid, hard, brown, valuable; used for shuttles. The drupes are reputed to be poisonous. Me. and Ont. to Fla., Minn., Mo., and Texas.

Order, RUBIALES.

Rubiaceae. Madder Family.

82. **Cephalánthus** L. Buttonbush.

Shrubs or small trees with opposite or whorled, entire, pinnately veined, deciduous leaves and prominent stipules.

Flowers small, white, densely capitate, tetracyclic; perianth tetramerous; stamens 4; fruits dry, 1-2-seeded.

1. **Cephalanthus occidentális** L. Buttonbush. A shrub

or small tree with petioled, ovate or oval, entire acute or acuminate leaves. In swamps and low grounds. N. B. to Ont. and Wis., Fla., Tex., Ariz., and Cal.

Caprifoliaceae. Honeysuckle Family.

83. *Viburnum* (Tourn.) L. *Viburnum*.

Shrubs or small trees with opposite, simple, serrate or lobed leaves; with 3 bundle scars; and with a terminal bud showing a large and a small pair of scales.

Flowers in compound cymes, tetracyclic; perianth and andrecium pentamerous; fruit a 1-seeded drupe.

1. Leaves prominently acuminate; petioles slender, margined. *V. lentago*.

1. Leaves obtuse or merely acute. 2.

2. Petioles slender, rarely margined; leaves glabrous or nearly so. *V. prunifolium*.

2. Veins of the lower leaf surfaces and winged petioles tomentose. *V. rufidulum*.

1. *Viburnum lentago* L. Sheepberry. A shrub or small tree with glabrous acuminate winter buds. Drupe reddish-black, with a bloom, sweet and edible. Wood hard, orange-brown, ill-smelling. In rich soil. Hudson Bay to Man., N. J., Ga., Ohio, Kan., and Col.

2. *Viburnum prunifolium* L. Black Haw. A shrub or small tree with acute winter buds, often reddish-pubescent. Drupe blue-black, glaucous, sweet and edible. Wood hard, reddish-brown. In dry soil. Conn. to Ga., Mich., Kan., and Texas.

3. *Viburnum rufidulum* Raf. Southern Black Haw. A small tree with elliptic or obovate, mostly obtuse leaves, with brown-tomentose, winged petioles. Wood ill-smelling. On uplands and dry flood plains. N. J. to Mo., Kan., Fla., and Texas.

APPENDIX.

KEY TO THE FRUITS.

The complete fruit at maturity, including the peduncle, is required for determination. The number after each genus refers to the list number.

1. Fruit a cone, a cone-like catkin, a compact aggregate, or an ordinary catkin. 2.
1. Fruit simple, consisting of a single carpel or set of united carpels, not cone-like or catkin-like, but often clustered. 22.
2. Fruit dry at maturity. 3.
2. Fruit fleshy. 16.
3. Fruit a globular aggregate of flowers on a long slender peduncle. 4.
3. Fruit not globular, except in some true cones, but ovoid or cylindrical, peduncle short, or if rather long then thick and rigid. 5.
4. Fruit an aggregate of dehiscent spiny-pointed capsules with several seeds. **Liquidambar.** (58).
4. Fruit an aggregate of 1-seeded nutlets, not spiny-pointed. **Platanus.** (59).
4. Fruit an aggregate of dry obpyramidal pods showing a prominent calyx at the tip; receptacle with bristles. **Cephalanthus.** (82).
5. Fruit a true cone with naked seeds, or an aggregate of closed carpels showing stamen, petal and sepal scars on the peduncle. 6.
5. Fruit a catkin or a cone-like catkin. 19.
6. Seeds in closed carpels, the cone-like fruit showing stamen, petal, and sepal scars at the base on the peduncle. 7.
6. Fruit a true cone with naked seeds, not showing stamen, and sepal scars on the peduncle. 8.

7. Carpels of the fruit forming dehiscent follicles at maturity; the fleshy seeds suspended from the pink or rose tissues of the fruit by slender threads. **Magnolia.** (12).
7. Carpels samara-like, dry and indehiscent. **Liriodendron.** (13).
8. Cones with numerous ovuliferous scales, more than 15.
9.
8. Cones with 3-12 ovuliferous scales. 12.
9. Cones erect, their scales deciduous from the persistent axis; ovuliferous scales orbicular or broad, obtuse.
Abies. (5).
9. Cones pendulous or projecting from the branch, the scales persistent. 10.
10. Cone scales woody and thickened at the outer end, elongated, often with a rigid point, spine, or prickle.
Pinus. (7).
10. Cone scales sub-oricular or oval, sometimes with erose or emarginate tips. 11.
11. Cone with subulate leaf-scales at the base. **Larix.**
11. Cone without subulate leaf-scales at the base, short and ovoid, usually less than 1½ in. long. **Tsuga.** (4).
11. Cone without subulate leaf-scales at the base, cylindric or long ovoid, usually 1-6 in. long, scales often with erose or emarginate tips. **Picea.** (3).
12. Carpels spirally arranged. 13.
12. Carpels opposite. 14.
13. Cone globose, the scales closely compressed on the outside, seeds not winged. **Taxodium.** (2).
13. Cone ovoid, with subulate leaf-scales at the base, the carpellate scales loose and open; seeds somewhat winged. **Larix.** (6).
14. Carpels imbricate, not shield-shaped, with 1-3 (usually 2 seeds). 15.
14. Carpels shield-shaped, with 2-3 seeds, more or less winged. **Chamaecyparis.** (10).
15. Carpels 6-8, the four upper fertile. **Thuja.** (8).
15. Carpels 4-6, the two upper fertile. **Libocedrus.** (9)
16. Fruit globose, over 2 in. in diameter. 17.

16. Fruit elongated, ovoid or cylindrical. 18.
17. Fruit green or yellowish-green, 3-5 in. in diameter.
Maclura. (65).
17. Fruit an aggregate of red drupes projecting beyond the persistent perianths. **Broussonetia.** (64).
18. Fruit very juicy, consisting of a catkin-like aggregate of small fleshy flowers. **Morus.** (63).
18. Fruit an aggregate of carpels, the ripe follicles dehiscent, and the seeds pendant from slender threads.
Magnolia. (12).
18. Fruit a small blue berry-like cone. **Juniperus.** (11).
19. Catkin composed of capsules with numerous seeds having tufts of cottony hairs. 20.
19. Catkin containing 1-seeded nutlets, achenes, or samara-like nutlets. 21.
20. Capsule with a little cup at the base. **Populus.** (76).
20. No cup at the base of the capsule but 1 or 2 little glands may be present. **Salix.** (77).
21. Fruiting catkin with leaf-like bracts; nutlets with ridges, somewhat compressed. **Carpinus.** (69).
21. Fruiting catkin hop-like, with bladder-like bracts; nutlets somewhat compressed, ridges inconspicuous.
Ostrya. (70).
21. Fruiting catkin woody and cone-like, nutlets small compressed, winged or wingless. **Alnus.** (72).
21. Fruiting catkin compact with rather thin scale-like bracts, cone-like; nutlets compressed, membranous-winged; samara-like. **Betula.** (71).

— 22 —

22. Fruit a dry or nearly dry samara, nut, achene, bean, or capsule, or a dry drupe. 23.
22. Fruit fleshy, indehiscent. 55.
23. Fruit or the peduncle prominently winged. 24.
23. Fruit and peduncle not with wings. 30.
24. Peduncle of the fruit cluster with a large wing; fruit a dry drupe. **Tilia.** (20).
24. Peduncle not winged; fruit a true samara, or with 1 or more prominent wings. 25.

25. Fruit with a prominent spine-like beak at the tip and with 2 or 4 wings, large. **Halesia**. (27).
25. Fruit not with a prominent spine-like point. 26.
26. Fruit double with 2 cavities and 2 large wings.
Acer. (53).
26. Samara with a wing all around or with a single wing at the end. 27.
27. Samara circular, oval, or broader than long. 28.
27. Samara elongated. 29.
28. Wing extending around the fruit, very veiny, glabrous; long-peduncled, calyx not present or very inconspicuous; cavities 2, 1 usually empty. **Ptelea**. (18).
28. Wing notched at the apex, usually veiny; fruit long-peduncled, calyx present; cavity with 1 seed.
Ulmus. (62).
28. Wing on the two sides of the fruit, with 2 stigmas at the apex; fruit sessile, small. **Betula**. (71).
29. Wing extending as far below the central seed as beyond it. **Ailanthus**. (19).
29. Wing terminal or extending along the sides of the seed but not beneath it. **Fraxinus**. (30).
30. Fruit a dehiscent bean, follicle, or capsule, usually with several seeds. 31.
30. Fruit an indehiscent nut, achene, or dry drupe with 1 cavity and 1-2 seeds; often partly or completely enclosed in a cup or husk. 47.
31. Fruit a bean or legume with 1 cavity and 2 sutures; seeds not winged. 32.
31. Fruit a capsule; if bean-like then with 2 cavities. 35.
32. Bean an inch or more broad, mostly with pulp. 33.
32. Bean about $\frac{1}{2}$ in. broad, without pulp. 34.
33. Bean very hard and thick, seed $\frac{3}{4}$ in. long.
Gymnocladus. (41).
33. Bean not very woody, thin, seed less than $\frac{1}{2}$ in. long.
Gleditsia. (42).
34. Bean with a prominent ridge on each side of one suture, apex long-acute. **Cercis**. (43).
34. Bean with the 2 sutures nearly alike, apex mucronate, or with a slender point, sometimes bristly.
Robinia. (45).

34. Bean usually irregular and somewhat constricted into joints, apex abruptly acute, calyx containing long filaments. **Cladrastis**. (44).
35. Seed with wings or a tuft of cottony hairs. 36.
35. Seed without wings or hairs. 39.
36. Seed with a tuft of hairs, capsule small. 37.
36. Seed with wings, the wings sometimes with a fringe of long hairs. 38.
37. Capsule with a little cup at the base. **Populus**. (76).
37. No cup at the base of the capsule but 1 or 2 little glands may be present. **Salix**. (77).
38. Capsule very long, wings of seed with a fringe of hairs. **Catalpa**. (32).
38. Capsule short, wings of seed without hairs. **Paulownia**. (31).
39. Seeds very large, $\frac{1}{2}$ -2 in. in diameter. 40.
39. Seeds much less than $\frac{1}{2}$ in. in diameter. 41.
40. Seed smooth with a large light spot at one end, without ridges or angles. **Aesculus**. (52).
40. Seed with two or more vertical ridges, without a special light spot—a nut in an enclosing husk which may be mistaken for a capsule. **Carya**. (73).
41. Seeds with a fleshy, scarlet aril, capsule lobed. **Euonymus**. (47).
41. Seeds without an aril. 42.
42. Seeds 1 or 2, capsule not bladdery. 43.
42. Seeds several to many. 44.
43. Capsules small without a cup at the base. **Zanthoxylum**. (17).
43. Capsule woody, $\frac{1}{2}$ in. long, with prominent cup at the base; seeds 2, oblong. **Hamamelis**. (57).
43. Capsule splitting tardily, with the prominent calyx persistent at the tip. **Cephalanthus**. (82).
44. Capsule triocular, large, bladdery. 45.
44. Capsule with 5—many cavities, small. 46.
45. Capsule 3-lobed at the tip, with 3 styles, usually widest at the middle or toward the outer end. **Staphylea**. (49).
45. Capsule with a long, acute tip, with a single style, widest below the middle. **Koelreuteria**. (51).

46. Capsules mostly woody, oblong, puberulent; in corymbose or umbellate clusters. **Rhododendron**. (21).
46. Capsules depressed-globose, somewhat 5-lobed; in corymbose or umbellate clusters. **Kalmia**. (22).
46. Capsules ovoid-pyramidal, 5-angled; in large paniced racemes. **Oxydendrum**. (23).
47. Fruit a dry drupe, or drupe-like; exocarp softer than the bony endocarp. 48.
47. Fruit a nut or achene, the pericarp not in 2 layers; often partly or completely enclosed in a cup or husk. 49.
48. Fruit globose, $\frac{1}{2}$ in. or more in diameter, on winged peduncles. **Tilia**. (20).
48. Fruit obliquely ovoid, compressed, ridged on the back and covered with prominent soft processes.
Planera. (61).
48. Fruit subglobose, nearly symmetrical, $\frac{1}{8}$ in. long, pubescent, red. **Rhus**. (54).
48. Fruit subglobose, nearly symmetrical, $\frac{1}{8}$ in. long; light gray, stone striate. **Toxicodendron**. (55).
48. Fruit obliquely oblong or oval, compressed, gibbous, $\frac{1}{8}$ in. long, reticulate-veined. **Cotinus**. (56).
49. Nut sharply 3-angled; usually 2 together in the 4-valved bur. **Fagus**. 68.
49. Nut not 3-angled. 50.
50. Nut less than $\frac{1}{2}$ in. long, somewhat compressed. 51.
50. Nut large, more than $\frac{1}{2}$ in. long, or if not then circular in cross-section. 52.
51. Nut with ridges; fruiting bract 3-cleft and incised.
Carpinus. (69).
51. Ridges of the nutlet inconspicuous, fruiting bract bladder-like. **Ostrya**. (70).
52. Nut with 2 or 3 prominent ridges, sometimes with rough wrinkles. 53.
52. Nut not with ridges. 54.
53. Nut rugose or sculptured; husk indehiscent.
Juglans. (74).
53. Nut smooth or angled, husk at length splitting into segments. **Carya**. (73).

- 54. Nut ovoid-oblong or subglobose; cup with imbricated, more or less united bracts. **Quercus.** (66).
- 54. Nut plano-convex or rounded; bur globose and very prickly. **Castanea.** (67).
- 54. Seed, which may be mistaken for a nut, not showing a style, large and shining; capsules splitting into 3 valves. **Aesculus.** (52).

— 55 —

- 55. Fruit a pome, the carpels enclosed by an adnate, perigynous disk or hypanthium. 56.
- 55. Fruit a berry, or berry-like, with several seeds. 60.
- 55. Fruit a drupe, or drupe-like, with a stone or pit and with 1 or rarely 2 seeds. 66.
- 56. Ripe carpels of the pome papery or leathery. 57.
- 56. Ripe carpels bony. **Crataegus.** (40).
- 57. Pome small and berry-like. 58.
- 57. Pome large, fleshy like the apple. 59.
- 58. Pome scarlet when ripe, cavities not more than 5. **Sorbus.** (35).
- 58. Pome purplish-red to purplish-blue when ripe, cavities usually 10. **Amelanchier.** (34).
- 59. Seeds not more than 3 in each cavity; pome tapering into the peduncle; flesh with grit-cells. **Pyrus.** (37).
- 59. Seeds not more than 3 in each cavity; pome sunk in at both ends, its flesh without grit-cells. **Malus.** (36).
- 59. Seeds many in each cavity, flesh of pome hard. **Cydonia.** (38).
- 60. Berry large, very much elongated, green with yellow pulp and large brown seeds. **Asimina.** (14).
- 60. Berry ovoid or globose. 61.
- 61. Berry about 1 in. in diameter, reddish-yellow, with 4-12 large, flat, hard seeds and with the enlarged calyx at the base. **Diospyros.** (25).
- 61. Berry not over $\frac{3}{4}$ in. in diameter. 62.
- 62. Fruit inferior, showing scars or parts of the perianth and stamens at the tip. 63.

62. Fruit superior, showing only the style at the tip, with scars or perianth parts if present at the base. 64.
63. Fruit scarlet, cavities 5. **Sorbus.** (35).
63. Fruit purplish-red to purplish-blue, cavities usually 10. **Amelanchier.** (39).
63. Fruit black, small, cavities 5. **Aralia.** (78).
64. Fruit really a berry-like blue cone, showing the carpel tips on the sides, on close inspection. **Juniperus.** (11).
64. Fruit not a modified cone, but a true berry. 65.
65. Berry-like drupe usually red or yellowish with 4-8 bony or crustaceous nutlets. **Ilex.** (48).
65. Berry-like drupe black, with 2-4 seed-like nutlets. **Rhamnus.** (46).
65. Berry very saponaceous, dark; seeds 1-3, crustaceous, globose. **Sapindus.** (50).
65. Berry black, with 1 erect, shining seed. **Bumelia.** (24).
65. Berry dark blue with 1 seed, $\frac{1}{2}$ - $\frac{3}{4}$ in. in diameter. **Persea.** (15).
66. Fruit large, usually 2 in. or more in diameter; stone or nut deeply pitted, corrugated, or sculptured, usually $1\frac{1}{2}$ in. or more long. 67.
66. Stone not deeply pitted, corrugated, or sculptured, not more than $\frac{3}{4}$ in. long; if reticulated, then less than $\frac{1}{2}$ in. long. 68.
67. Flesh of fruit black or greenish, hard, with strong odor; seed in the nut much wrinkled. **Juglans.** (74).
67. Drupe pubescent, its flesh sweet; seed in the stone smooth. **Amygdalus.** (34).
68. Drupe white-waxy, less than $\frac{1}{2}$ in. in diameter, globose, tuberculate. **Myrica.** (75).
68. Drupe not white-waxy, if somewhat resinous then much larger. 69.
69. Fruit superior, showing only a style or its scar at the tip but usually the remains of a calyx below. 70.
69. Fruit inferior, showing sepals, petals, and stamens or their remains or scars at the tip. 75.
70. Drupe with red acid hairs, small. **Rhus.** (54).
70. Drupe light gray, small, stone striated. **Toxicodendron.** (55).

70. Drupe not with red acid hairs nor gray with striated stone. 71.
71. Drupe narrowly oblong, about 1 in. long.
Forestiera. (29).
71. Drupe globose, oval, or globose-oblong. 72.
72. Stone ridged and reticulated, showing prominent teeth in cross-section. **Celtis.** (60).
72. Stone smooth, or if somewhat roughened then with a prominent suture all around. 73.
73. Fruiting pedicel much thickened below the prominent calyx base, red; drupe oblong-globose, blue.
Sassafras. (16).
73. Fruiting pedicel somewhat thickened, red or reddish, the drupe-like berry dark blue. $\frac{1}{2}$ - $\frac{3}{4}$ in. in diameter.
Persea. (15).
73. Fruiting pedicel not thickened below the calyx or if so the fruit not blue. 74.
74. Fruit light greenish-yellow; flesh with a sickening-sweet odor and a sticky juice; embryo in a large kernel; a gymnospermous seed. **Ginkgo.** (1).
74. Drupe often large and sweet, stone with a suture all around, often flattened. **Prunus.** (33).
74. Drupe with a 4-6 lobed calyx; oblong-ovate, blue; endosperm large with a small embryo in the center.
Chionanthus. (28).
74. Fruit really a small black berry; seed shining, with the hilum at the base. **Bumelia.** (24).
75. Stone with 2 cavities and 2 seeds. 76.
75. Stone usually with 1 seed. 77.
76. Drupe white or blue. **Cornus.** (80).
76. Drupe red. **Cynoxylon.** (81).
77. Stone with 1 cavity and 1 seed, grooved and somewhat compressed; drupe glabrous, blue or nearly black.
Nyssa. (79).
77. Fruit with prominent nerves and ridges, with 5 sepals, tips, oblong-ovate, pubescent, nearly dry, nutlike.
Symplocos. (26).
77. Stone 1-seeded, sometimes flattened; drupe with a prominent styler beak, blue, black, or red.
Viburnum. (83).

A GENERAL CLASSIFICATION OF THE WOOD OF TREES INCLUDED IN THE MANUAL.

- A. Wood without annual rings but with scattered vascular bundles. **Monocotylae.**
(No trees in our region.)
- B. Wood in a growing cylinder, showing annual rings, with a central pith.
 - I. Wood non-porous, the cells not visible or conspicuous in cross section even with a hand lens, there being no wood vessels; annual rings distinct by denser dark-colored bands of late wood. **Ginkgoae** and **Coniferae.**
 - 1. Resin-ducts present in cross section.
 - a. Without distinct heartwood. **Picea.**
 - b. With distinct heartwood. **Larix, Pinus.**
 - 2. Resin-ducts not present in the wood.
 - a. Resin-ducts in the pith. **Ginkgo.**
 - b. Pith without resin-ducts.
 - (a) Without distinct heartwood. **Abies, Tsuga.**
 - (b) With distinct heartwood, either of a different color or of a deeper shade than the sapwood.
 - ((a)) Without a sharp demarcation in color between the heartwood and sapwood, the one fading gradually into the other. **Taxodium, Chamaecyparis, Thuja.**
 - ((b)) With a clear demarcation in color between the heartwood and the sapwood. **Libocedrus, Juniperus.**
 - II. Wood porous; the pores, or true wood vessels, being visible in cross section with a hand lens or to the naked eye. **Dicotylae.**
 - 1. Wood diffuse-porous; pores numerous and usually not plainly visible in cross section without

a hand lens; annual rings distinct by a fine line of denser late wood cells, often quite indistinct; pores scattered through the annual ring; no zone or no definite ring of collected pores in the early wood. *Magnolia*, *Liriodendron*, *Persea*, *Tilia*, *Rhododendron*, *Kalmia*, *Oxydendrum*, *Symplocos*, *Halesia*, *Forestiera*, *Prunus*, *Amygdalus*, *Sorbus*, *Pyrus*, *Malus*, *Cydonia*, *Amelanchier*, *Crataegus*, *Euonymus*, *Ilex*, *Staphylea*, *Aesculus*, *Acer*, *Hamamelis*, *Liquidambar*, *Platanus*, *Fagus*, *Carpinus*, *Ostrya*, *Betula*, *Alnus*, *Juglans*, *Myrica*, *Populus*, *Salix*, *Cornus*, *Cynoxylon*, *Nyssa*, *Cephalanthus*, *Viburnum*.

- a. Among the above, those having highly colored or dark heartwood are the following:
Persea, *Prunus*, *Amygdalus*, *Liquidambar*, *Fagus*, *Juglans*, *Oxydendrum*, *Halesia*.
2. Wood ring-porous, the pores or wood vessels numerous and usually visible in cross section without a hand lens; annual rings distinct by a zone or ring of large pores in the early wood alternating with a denser zone of late wood containing fewer or smaller pores. *Asimina*, *Sassafras*, *Zanthoxylum*, *Ptelea*, *Ailanthus*, *Bumelia*, *Diospyros*, *Chionanthus*, *Fraxinus*, *Paulownia*, *Catalpa*, *Cercis*, *Gleditsia*, *Gymnocladus*, *Cladrastis*, *Robinia*, *Rhamnus*, *Sapindus*, *Koelreuteria*, *Rhus*, *Toxicodendron*, *Cotinus*, *Ulmus*, *Planera*, *Celtis*, *Morus*, *Maclura*, *Broussonetia*, *Castanea*, *Quercus*, *Carya*, *Aralia*.
2. Among the above, those having highly colored or dark heartwood are the following:
Asimina, *Diospyros*, *Catalpa*, *Gymnocladus*, *Cercis*, *Gleditsia*, *Robinia*, *Rhus*, *Toxicodendron*, *Cotinus*, *Morus*, *Maclura*, some species of *Quercus*, *Carya*, *Aralia*.

GLOSSARY

Acène. A one-seeded dry indehiscent fruit with a tightly fitting pericarp around the seed.

Actinomorphic. Radially symmetrical; a flower or organ which can be cut into similar equal halves by two or more planes.

Acuminate. Tapering gradually to the apex.

Acute. Sharp pointed.

Adnate. An organ united to another; an anther attached longitudinally to the end of the filament.

Adventive. Apparently becoming naturalized.

Alternate. With a single leaf or other organ at each node.

Ament. A slender usually flexible spike of flowers, as in the willows.

Andrécium. The whole set of stamens in a flower.

Anther. The spore-bearing part of a stamen; the part which finally contains the pollen sacs.

Anthesis. The period of flowering.

Apétalous. Without petals.

Appressed. Lying close against another organ.

Aril. A fleshy organ around the hilum.

Auricled. With ear-like lobes.

Axil. The point of a stem just above the base of the leaf.

Axile. In the axis of an organ.

Axillary bud. A bud in the axil of a leaf.

Baccate. Berry-like.

Berry. A fruit with a fleshy or pulpy pericarp.

Bilócular (2-locular). Having two cavities.

Bipinnátifid. Twice pinnatifid.

Bisporángiate. Having both microsporangia and megasporangia; having both stamens and carpels.

Blade. The expanded part of a leaf.

Bract. A small, rudimentary, or imperfectly developed leaf.

Bud scale. One of the scale leaves in the winter bud.

Bundle scar. A scar in a leaf scar produced by a vascular bundle or strand of bundles.

Cadúceous. Falling away very soon after development.

Cályx. The outer set of sterile floral leaves; the whole set of sepals.

- Cámbium.** The cylinder of growing cells in the stems of conifers and dicotyls.
- Canéscent.** With gray or hoary fine pubescence.
- Cápite.** Arranged in a head.
- Cápsule.** A dry fruit of two or more carpels usually dehiscent by valves or teeth.
- Cárpel.** The megasporophyll of a seed plant; the modified leaf bearing the ovules.
- Cárpellate.** Having only carpels, or carpellate flowers.
- Cárpellate bract.** A bract representing the modified blade of a carpel as in firs and pines.
- Cátkin.** Same as ament.
- Càuline.** Pertaining to the stem.
- Chaff.** Dry thin scales.
- Chlórophyll.** The green coloring matter of plants.
- Choripétalous.** Having the petals separate or free.
- Cíliate.** Provided with marginal hairs.
- Cíliolate.** Minutely ciliate.
- Cómpound.** Composed of several parts or divisions.
- Conduplicate.** Folded lengthwise.
- Cone.** A primitive flower as the carpellate cone of the pine; a strobilus.
- Cónnate.** Similar organs more or less united.
- Cónvolute.** Rolled around or rolled up longitudinally.
- Córdate.** Heart-shaped.
- Coriáceous.** Leathery.
- Corólla.** The inner set of sterile, usually colored, floral leaves; the whole set of petals.
- Córymb.** A convex or flat-topped inflorescence of the racemose type.
- Cotylèdon.** A leaf-like organ of the embryo in the seed.
- Crèmate.** With rounded teeth.
- Crénulate.** Minutely crenate.
- Cùneate.** Wedge-shaped.
- Cúspidate.** With a sharp stiff point.
- Cýme.** An inflorescence of the determinate type, the central flower developing first.
- Cýmose.** Having cymes; or like cymes.
- Decíduous.** Falling away at the end of the growing period.
- Dècòmpound.** More than once compound.

Decurrent. Applied to an organ extending along the side of another.

Dehiscence. The opening of an ovulary, sporangium, or pollen sac for the discharge of the contents.

Déltoid. Broadly triangular.

Déntate. With outwardly projecting teeth.

Denticulate. Finely toothed.

Detérminate. Definite or fixed, as when a flower develops at the end of a stem; or the stopping of growth of the floral axis.

Diadélphous. Having the stamens united into two sets.

Diaphragm. A septum or transverse plate in the pith or other parts.

Dichótomous. Two-forked.

Dídymous. Twin-like.

Diécious. Having the microsporangiate or staminate flowers and the megasporangiate or carpellate flowers on separate plants.

Dígitate. Diverging like the spread fingers.

Dissécted. Divided into many segments.

Divided. Cleft to the base or to the midrib.

Drúpe. A simple usually indehiscent fruit with fleshy exocarp and bony endocarp.

Dwarf branch. A highly specialized and reduced shoot bearing leaves, as in the pine and larch.

Emàrginate. With a notched apex.

Embryo. An incipient plant especially in the seed.

Embryo sac. The female gametophyte, contained in the ovule of seed plants.

End bud. The bud at the end of the twig in case the terminal bud is self-pruned.

Endocarp. The inner layer of the pericarp.

Endosperm. The nourishing tissue developed around the embryo in the female gametophyte of the anthophyta.

Entire. Without teeth, serrations or lobes.

Ephéméral. Continuing for only a day or less.

Epígynous. Having the calyx, corolla, and andrecium above the ovulary.

Evanéscént. Disappearing early.

Exocarp. The outer layer of the pericarp.

Exserted. Extending beyond surrounding organs or parts.

Extrorse. Facing outwards.

Falcate. Scythe-shaped.

Fértilé. Bearing spores or seeds.

Fertilizàtion. The conjugation of the male and female gametes.

Fétid. Ill-smelling.

Filament. The stalk of an anther.

Flówer. A determinate sporophyll-bearing shoot, or a modification of such a shoot; in the anthophyta commonly with a perianth.

Foliáceous. Leaf-like.

Fóllicle. A simple fruit dehiscent along one suture.

Fruit. The ripe ovulary with the seeds and whatever parts are consolidated with it.

Fugáceous. Falling soon after development.

Fúgitive. Plants not native, but recurring here and there, without apparently becoming established.

Gámete. A sexual cell.

Gamétophyte. The sexual generation of plants, producing the eggs and sperms.

Geóphilous. Earth-loving; growing partly or completely subterranean.

Germinàtion. The division or budding of a spore or reproductive cell.

Gibbous. Enlarged or swollen on one side.

Glábrate. Nearly without hairs.

Glàbrous. Without hairs.

Gland. A group of secreting cells, or a gland-tipped hair.

Glàucous. Covered with a bluish or white bloom.

Glòbose. Spherical or nearly so.

Glútinous. Sticky or gummy.

Gynécium. The whole set of carpels in a flower.

Hábit. General aspect.

Hábitat. The place where a plant grows.

Hástate. Arrow-shaped with the basal lobes diverging.

Head. A dense, round inflorescence of sessile or nearly sessile flowers.

Herbaceous. Leaf-like in texture and color.

Hilum. The scar on a seed where the funiculus was attached.

Hirsute. Having rather coarse stiff hairs.

Hispid. With bristly stiff hairs.

Hyaline. Clear and translucent.

Hydrophyte. A water plant.

Hypánthium. Any enlargement or special development of the torus, in a flower, on which the sepals, petals, and stamens are borne; a perigynous or epigynous disk.

Hypógynous. Having the calyx, corolla, and andrecium below the gynecium.

Imbricated. Overlapping.

Impérfect. Monosporangiate flowers; having only stamens or only carpels.

Incised. Cut into sharp lobes.

Included. Not projecting beyond surrounding parts.

Indehiscent. Not opening.

Indigenous. Native to the place.

Inequilátral. With unequal sides.

Inférieur. Situated or arising below other organs.

Infloréscence. The flower cluster of a plant and its mode of arrangement.

Internode. The part of a stem between two successive nodes.

Introrse. Facing inwards.

Involùcre. A whorl of bracts subtending a flower or flower cluster.

Involute. Rolled inwardly.

Irrégular. A flower with one or more organs of a set unlike the others.

Isobilátral. A flower or organ which can be cut into equal halves by two planes, the halves of the one being unlike those of the other.

Keel. A projecting ridge.

Lánceolate. Lance-shaped.

Látéral bud. An axillary bud, any bud not the terminal bud of a branch.

Làtex. The milky sap of certain plants.

Leaf. An expanded lateral organ arising from the axis or

- branch of a sporophyte, usually specialized to carry on the functions of photosynthesis and transpiration.
- Léaſſet. One of the divisions of a compound leaf.
- Leaf ſcar. The ſcar or cicatrix formed where the petiole of a leaf ſeparates from the ſtem or twig.
- Légume. A ſimple, dry fruit dehiscent along both ſutures.
- Lénticel. A ſmall uſually oval or rounded ſpot on the bark of a twig or ſtem, produced by a ſpecial tissue of cells under a ſtoma and breaking through the epidermis.
- Límſ. The expanded part of a petal, ſepal, or ſympetalous corolla.
- Línear. A long and narrow organ with the ſides nearly parallel.
- Lòbed. Divided to about the middle or leſs.
- Loculicidal. A capſule which ſplits longitudinally through the middle of the back of each cavity or component carpel.
- Médullary rays. Strips of cells paſſing radially through the wood from the pith or annual rings to the bark.
- Mégaspore. The larger of the two kinds of reduction ſpores produced in the flower. The megaspore develops into the female gametophyte.
- Megasporangium. A ſporangium which produces megaspores; the ovule in ſeed plants.
- Mémbranous. Thin and rather ſoft and pliable.
- Méſophyte. A land plant adapted to ordinary conditions of moiſture.
- Microſpore. The ſmaller of the two kinds of reduction ſpores produced in the flower. The microſpore develops into the male gametophyte or pollen grain.
- Microſporángium. A ſporangium which produces the microſpores; the incipient pollen ſacs in the ſeed plants.
- Mídrib. The central rib of a leaf or other organ.
- Monadélphous. Stamens with united filaments.
- Monècious. Having ſtaminate and carpellate flowers on the ſame plant.
- Monosporángiate. Flowers bearing only one kind of ſpores; a flower with only ſtamens or carpels.
- Múcronate. With a ſharp abrupt point.
- Mucrónulate. Slightly mucronate.

- Naturalized.** Plants not indigenous to a region but having become established as part of the flora.
- Natural pruning.** The process by which dead twigs and branches are separated from the tree by the formation of a collar or callus.
- Nectary.** A nectar-secreting organ.
- Node.** The place where two internodes join, normally with a single leaf or more.
- Nucleus.** A dense, more or less spherical, complex, protoplasmic body present in cells.
- Nut.** An indehiscent one-seeded fruit with a hard or bony pericarp.
- Nutlet.** A very small nut.
- Obcordate.** Inversely heart-shaped.
- Oblanceolate.** Inversely lanceolate.
- Oblong.** Somewhat longer than broad with the sides nearly or quite parallel.
- Obovate.** Inversely ovate.
- Oosphere.** The unfertilized egg; the female gamete.
- Oospore.** The fertilized egg.
- Orbicular.** Nearly circular in outline.
- Ovary.** The female organ of reproduction; an egg-producing organ.
- Ovate.** Shaped like the longitudinal section of a hen's egg.
- Ovulary.** The ovule-bearing part of a closed carpel or set of carpels.
- Ovule.** The megasporangium of a seed plant which later develops into a seed.
- Ovuliferous scale.** An outgrowth on a conifer carpel bearing the ovules as in the spruce or pine.
- Ovum.** The egg or oosphere.
- Palmate.** Diverging like the fingers of a hand.
- Panicle.** A compound inflorescence of the racemose type, usually of pyramidal form.
- Parasitic.** Growing upon other living plants or animals and absorbing their juices and tissues as food.
- Parietal.** Borne on the wall of the ovulary, or pertaining to it.
- Parted.** Deeply cleft.
- Pédicel.** The stalk of a flower in a flower cluster.

- Pedúncle.** The stalk of a flower or flower cluster.
- Pellúcid.** Transparent.
- Péltate.** Shield-shaped, as a leaf with the petiole attached at or near the center of the blade.
- Pentacýclíc.** Having five cycles.
- Pentámerous.** Five-parted.
- Pérfect.** A flower having both stamens and carpels.
- Perfóliate.** Leaves so clasping the stem as to appear as if pierced by it.
- Périanth.** The calyx and corolla taken collectively.
- Péricarp.** The wall of a fruit; the ovulary wall.
- Perigynous.** Having the sepals, petals and stamens borne on a disk or hypanthium surrounding the gynecium.
- Persistent.** Remaining attached after the growing period.
- Pétal.** One of the leaves of the corolla.
- Pétiole.** The stalk of a leaf.
- Pilose.** With long soft hairs.
- Pínna.** The primary divisions of a pinnately compound leaf.
- Piñna.** The primary divisions of a pinnately compound leaf.
- Pinnate.** Leaves divided into leaflets or segments along a common axis.
- Pinnátifid.** Pinnately cleft to the middle or beyond.
- Pínnule.** A division of a pinna in a compound leaf.
- Placéнта.** The ridge or surface bearing the ovules.
- Plicate.** Folded like a fan.
- Plúmose.** Resembling a plume or feather.
- Plurilócular.** Having several or many cavities.
- Póllen grain.** The male gametophyte of seed plants.
- Pome.** The fruit of the apple and related plants, with an adnate fleshy perigynous disk.
- Príckle.** A stiff sharp-pointed outgrowth from the epidermis.
- Pubérulent.** With very short hairs.
- Pubéscent.** Hairy, especially with fine and soft hairs.
- Púncťate.** With translucent dots or glands.
- Racème.** An elongated inflorescence with each flower on a pedicel.
- Rácemose.** Like a raceme; or in a racime.
- Ráchis.** The axis of a compound leaf, spike or raceme.
- Recéptacle.** The end of the flower stalk bearing the floral organs.

Refléxed. Bent backward abruptly.

Régular. Having the parts of each set alike in size and shape.

Réniform. Kidney-shaped.

Repánd. With a more or less wavy margin.

Retùse. With a shallow notch at the end.

Révolute. Rolled backward.

Ròtate. With a flat round corolla; wheel-shaped.

Ságittate. Shaped like an arrow head.

Sámara. A simple indehiscent winged fruit.

Scàbrous. Rough.

Scale. A highly modified dry leaf as in the winter bud of most plants; also a dry, flat, more or less membranous outgrowth from a leaf or stem.

Scúrfy. Covered with scurf, minute membranous scales, as in *Chenopodium*.

Scàrious. Thin, dry, and translucent, not green.

Seed. The matured and modified ovule with a dormant embryo.

Sélf-pruning. The process by which living buds or twigs are naturally separated from the plant.

Sélf-pruning scar. A scar produced where a twig or bud has been self-pruned.

Sépal. One of the leaves of a calyx.

Septicidal. A capsule which splits longitudinally through its partitions thus dividing it into its component carpels.

Sérrate. With teeth projecting forward.

Séssile. Without a stalk.

Shoot. The aerial part of a plant including the stem and leaves.

Sínuate. With strongly wavy margins.

Sínus. The space between two lobes.

Spátulate. Widened at the top like a spatula.

Spérmary. The male reproductive organ.

Spermatozòid or sperm. The male gamete.

Spike. An elongated inflorescence with sessile or nearly sessile flowers.

Spine. A sharp thorn-like organ not representing a stem in origin but a leaf or part of a leaf, as the spines on the leaves of the Christmas holly.

Spore. A modified reproductive cell.

Spòrophyll. A spore-bearing leaf, usually highly modified in the seed plants.

Spòrophyte. The spore-producing generation of the higher plants.

Spròuting. The process by which the embryo breaks out of the seed; the renewed growth of a resting bud.

Spur. A short stunted branch not representing a true dwarf branch and not ending in a thorn-like point; any projecting appendage of a flower looking like a spur.

Stàmen. The organ of a flower which produces microsporangia, which contain the microspores which later develop into pollen grains.

Stàminate. Having only stamens or staminate flowers.

Stéllate. Star-like.

Sterigma. A small, short, peg-like projection on which certain leaves, spores, etc., are borne.

Stérile. Not producing spores or seeds.

Stigma. The upper part of the carpel; a special organ of the Angiosperms to catch the pollen grains.

Stipel. The stipule of a leaflet.

Stipular scar. The mark made on the bark by deciduous stipules.

Stipular spine. A spine representing a stipule or having the position of a stipule.

Stípules. Bract-like appendages at the base of the petiole of many leaves.

Stòma (Pl. stòmata). The transpiring pores in the epidermis of the higher plants.

Strigose. With stiff appressed or ascending hairs.

Stròbilus. A primitive type of flower; a cone.

Style. The narrow top of the carpel or united carpels between the ovulary and stigma.

Súbulate. Awl-shaped.

Súcculent. Soft and juicy.

Superpòsed. Placed one above the other.

Sympétalous. With petals more or less united.

Synántherous. Having the stamens united by their anthers.

Sýncarp. A fleshy aggregate fruit.

Térete. Circular in cross section.

Término bud. The bud at the morphological tip of the twig.

Térnate. Divided into three segments; arranged in threes.

Tetracyclíc. A flower with four cycles.

Tetrádýnamous. With four long stamens and two short ones as in the Brassicaceae.

Tetrámerous. Four-parted.

Thorn. A highly modified sharp-pointed branch.

Thorn-like spur. A short stunted branch ending in a sharp point or thorn.

Tòmentose. Covered with dense wool-like hairs.

Toothed. Dentate.

Triadélphous. Having stamens united by their filaments into three bundles.

Trifòliate. A compound leaf with three leaflets.

Trilócular (3-locular). With three cavities.

Trimerous. Three-parted.

Trúncate. Terminating abruptly by a nearly straight edge or surface.

Túrbinate. Top-shaped.

Two-ranked. Disposed in two vertical rows along the twig; with the third leaf in line with the first.

Umbel. A determinate inflorescence with all the pedicels arising from the same point.

Uñdulate. With wavy margins.

Unilócular (1-locular). With one cavity.

Utricle. A one-seeded fruit with a loose pericarp.

Válvate. Meeting by the margins in the bud, not overlapping; dehiscent by valves.

Váscular bundle. The conducting strands in the plant body composed of wood and bast in which water and food materials are conducted through the roots, stems and leaves.

Vein. One of the branches of the vascular portion of leaves or other organs.

Venàtion. The arrangement of the veins.

Vernàtion. The arrangement of the leaves in the bud.

Vérsatile. An anther attached at or near its middle to the filament.

Vérticillate. Whorled.

Villous. With long, soft hairs not matted together.

Whórléd. A group of three or more similar organs radiating from a node.

Winged. With a thin expansion.

Xérophyte. A plant fitted to desert conditions.

Zygomórfhic. A flower or organ which can be cut into similar halves by only one plane.

I N D E X.

	PAGE		PAGE
Abies.....	48	Buckeye.....	92
Acer.....	93	Buckthorn.....	89
Adelia.....	63	Buckthorn, see Bumelia..	61
Aesculus.....	92	Bumelia.....	61
Ailanthus.....	58	Burning-bush, see Wahoo	90
Alder.....	116	Butternut.....	121
Alnus.....	116	Buttonbush.....	131
Amelanchier.....	74	Buttonwood, see Syca-	
Amygdalus.....	71	more.....	100
Angelica-tree.....	129	Canoe Birch, see Paper	
Apple.....	72	Birch.....	115
Apricot.....	68	Carpinus.....	113
Aralia.....	129	Carya.....	116
Arborvitae.....	52	Castanea.....	112
Ash.....	64	Catalpa.....	66
Asimina.....	57	Cedar, see Juniper.....	54
Aspen.....	124	Celtis.....	100
Bald-cypress.....	46	Cephalanthus.....	131
Basswood, see Linden...	59	Cercis.....	88
Bay.....	57	Chamaecyparis.....	53
Bayberry.....	121	Cherry.....	68
Beech.....	113	Cherry Birch, see Sweet	
Betula.....	114	Birch.....	115
Biota.....	53	Chestnut.....	112
Birch.....	114	Chinquapin.....	112
Bitternut.....	118	Chionanthus.....	63
Black Gum, see Tupelo..	130	Choke Pear, see Pear...	73
Black Haw.....	132	Cladrastis.....	88
Black Locust, see Com-		Coffee-bean.....	87
mon Locust.....	89	Cornel, see Dogwood....	130
Black Oak.....	109	Cornus.....	130
Bladdernut.....	91	Cotinus.....	98
Blue-beech.....	113	Cottonwood.....	123
Boxelder.....	96	Crab-apple.....	72
Braussonetia.....	103	Crataegus.....	75

	PAGE		PAGE
Cydonia.....	74	Juglans.....	121
Cynoxylon.....	131	Juneberry.....	74
Cypress.....	54	Juniper.....	54
Diospyros.....	62	Juniperus.....	54
Dogwood.....	130	Kalmia.....	61
Elm.....	101	Kentucky Coffeetree, see	
Euonymus.....	90	Coffee-bean.....	87
Fagus.....	113	Koelreuteria.....	92
Fir.....	48	Larch.....	49
Forestiera.....	63	Larix.....	49
Fraxinus.....	64	Laurel, see Rhododen-	
Fringetree.....	63	dron and Kalmia.....	60
Ginkgo.....	46	Libocedrus.....	53
Gleditsia.....	87	Liquidambar.....	99
Great Laurel, see Rhodo-		Linden.....	53
dendron.....	60	Liriodendron.....	56
Gymnocladus.....	87	Locust.....	89
Hackberry.....	100	Maclura.....	104
Halesia.....	63	Magnolia.....	55
Hamamelis.....	98	Maiden-hair-tree.....	46
Haw.....	132	Malus.....	72
Haw, see Hawthorn.....	75	Maple.....	93
Hawthorn.....	75	Mockernut.....	120
Hemlock.....	48	Morus.....	103
Hercules' Club, see An-		Mountain-ash.....	72
gelica-tree.....	129	Mountain Laurel, see	
Hickory.....	116	Kalmia.....	60
Hicoria.....	116	Mulberry.....	103
Holly.....	90	Myrica.....	121
Honey-locust.....	87	Nannybery, see Black	
Hop-hornbeam.....	113	Haw.....	132
Hoptree.....	58	Nyssa.....	130
Horse-chestnut.....	92	Oak.....	104
Ilex.....	90	Osage-orange.....	104
Incense-cedar.....	53	Ostrya.....	113
Iron Oak, see Post Oak.....	108	Oxydendrum.....	61
Ironwood, see Hop-horn-		Papaw.....	57
beam.....	113	Paper-mulberry.....	103
Judastree, see Redbud... ..	88	Papyrus.....	104

	PAGE		PAGE
Paulownia.....	66	Rock Maple, see Sugar	
Peach.....	71	Maple.....	95
Pear.....	73	Salix.....	124
Pecan.....	118	Sapindus.....	92
Pepperidge, see Tupelo..	130	Sassafras.....	57
Persea.....	57	Serviceberry, see June-	
Persimmon.....	62	berry.....	74
Picea.....	47	Shadbush, see Juneberry..	74
Pignut.....	119	Sheepberry.....	132
Pine.....	49	Silverbell.....	63
Pinus.....	49	Smoketree.....	98
Planera.....	101	Snowdrop tree, see Sil-	
Planertree.....	101	verbell.....	63
Planetree.....	99	Soapberry.....	92
Platanus.....	99	Soft Maple, see Silver	
Plum.....	68	Maple.....	96
Poison Elder, see Poison		Sorbus	72
Sumac.....	97	Sour Gum, see Tupelo... 130	
Poplar.....	122	Sorreltree.....	61
Poplar, Yellow, see Tu-		Sourwood, see Sorrel-	
liptree.....	56	tree.....	61
Populus.....	122	Spindletree.....	90
Prickly-ash.....	58	Spruce.....	47
Prunus.....	68	Stafftree.....	90
Ptelea.....	58	Staphylea.....	91
Pyrus.....	73	Sumac.....	97
Quercitron.....	110	Sweet-gum.....	99
Quercus.....	104	Sweetleaf.....	62
Quince.....	74	Sycamore.....	100
Redbud.....	88	Symplocos.....	62
Red Cedar, see Red Ju-		Tamarack.....	49
niper.....	54	Taxodium.....	46
Red Elm, see Slippery		Taxus	54
Elm.....	102	Thorn, see Hawthorn... 75	
Rhamnus.....	89	Thuja.....	52
Rhododendron.....	60	Tilia.....	59
Rhus.....	97	Toxicodendron.....	97
Robinia.....	89	Toxylon.....	104
Rock Elm, see Cork Elm	102	Tree-of-heaven.....	58

	PAGE		PAGE
Tsuga.....	48	White-cedar.....	53
Tuliptree.....	56	White Maple, see Silver	
Tupelo.....	130	Maple.....	96
Ulmus.....	101	Whitewood, see Linden...	59
Varnishtree.....	92	Willow.....	124
Viburnum.....	132	Witch-hazel.....	98
Wahoo.....	90	Yellow Oak, see Chest-	
Walnut.....	121	nut Oak.....	107
Water-beech, see Blue-		Yellow Poplar, see Tu-	
beech.....	113	liptree.....	56
Water Elm, see Planer-		Yellow-wood.....	88
tree.....	101	Yew.....	54
Wax-myrtle.....	122	Zanthoxylum.....	58

DATE OF ISSUE

This book must be returned
within 3, 7, 14 days of its issue. A
fine of ONE ANNA per day will
be charged if the book is overdue.

7

